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IMPACT OF STOCK INDEX FUTURES TRADING ON SPOT PRICE VOLATILITY: EVIDENCE FROM MATURE AND EMERGING MARKETS

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ABSTRACT

This study compares the effects of spot price volatility on stock index futures trading in developed and developing markets. We examine the relationships between futures trading and spot market volatility using a comprehensive dataset derived from four nations, especially Japan and the US (mature markets) and Mexico and South Korea (developing markets). Volatility in financial time-series data is modelled using a number of econometric methodologies, including the use of a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. To determine stationarity in the time series data, careful unit root analysis is also used in the research. Our findings help to clarify how derivative instruments work in the financial markets and offer insightful information to both investors and market authorities.

Keywords: GARCH model, futures trading, spot price volatility, mature markets, emerging markets, stock index futures, unit root analysis.

1. INTRODUCTION

This research paper focuses on the impact of futures trading on spot price volatility in mature and emerging markets. The debate on whether futures trading stabilizes or destabilizes spot prices has been ongoing for many years. Some studies suggest that futures trading can stabilize spot prices, while others argue that it exacerbates price volatility.

The paper reviews several studies that provide mixed findings on the relationship between futures trading and market volatility. For example, some studies show that futures trading increases volatility before or after certain events, while others indicate that it reduces volatility. The impact of futures trading on spot price volatility appears to vary depending on the specific market and conditions.

The purpose of this paper is to contribute to the ongoing debate by examining the impact of futures trading on spot price volatility in both mature and emerging markets. The researchers aim to determine whether futures trading has a stabilizing or destabilizing effect on spot prices and whether there are any differences between the two types of markets.
The study will use advanced econometric techniques to analyze the relationship between stock index futures trading and spot price volatility. The findings of this research will be valuable for policymakers, investors, and regulators, as it can provide insights into market stability, risk management, and financial regulation. Understanding the impact of futures trading on spot price volatility is crucial for making informed decisions in both mature and emerging markets.

2.REVIEW OF LITERATURE:

The literature reviewed suggests that there is a significant relationship between futures trading and spot market volatility. Many studies have been conducted on this topic, mainly focusing on stock index futures and commodity derivatives markets in both developed and emerging economies. The majority of these studies have employed econometric models, such as GARCH, to examine the impact of futures trading on spot market volatility.

Macroeconomic announcements' effects on emerging market bond returns and volatility were examined by Andritz Ky et al. in 2003, and they discovered a strong correlation. The FTSE-100 stock index futures contract was the subject of Antoniou and Holmes' (2010) investigation into the effect of futures trading on spot price volatility. They found that futures trading enhances spot price volatility and offers fresh market data.

When Antoniou and Foster (2010) examined the influence of futures trading on Brent crude oil spot price volatility, they discovered a sizable favorable effect. The impact of stock index futures on stock market volatility was examined by Guo (2013), who found a correlation. Illueca and Lafuente (2013) looked at how spot and futures trading affected stock index market volatility and discovered a strong and positive correlation.

Using the GARCH model, Debasish (2015) examined the influence of futures trading on spot price volatility in the NSE Nifty and discovered a sizable favorable impact. In their 2015 study on derivative trading in developing markets, Singh and Singh discovered that futures markets are essential for price discovery and risk management.

Studying price discovery and investor structure in stock index futures, Bohl, Salm, and Schuppli (2016) brought attention to the crucial role that futures trading plays in price discovery. In-depth volatility spillovers were discovered by Yang et al. (2016) when they looked at intraday price discovery and volatility transmission between stock index and stock index futures markets.

In the 2016 study, Sehgal et al. found a short-term positive correlation between futures trading and spot market volatility in Indian commodities markets. In their 2016 study, Kuo et al. found a substantial correlation between individual and institutional trading and futures returns and volatility in emerging index futures markets. Price discovery and volatility spillovers in Mexico's index futures markets were examined by Zhong et al. (2016), who discovered a substantial correlation.

The influence of futures trading on spot price volatility in the spot electricity market in France and Germany was examined by Kalantzis and Milonas (2017), who discovered a decrease in spot price volatility. In their 2017 study, Gao and Sun saw a reduction in stock

3.DATA COLLECTION:

The section presents data and econometric that is employed to find out the results.

4.Data Description:

This study mainly considers indices for each country of Mexico & South Korea as Emerging Markets and Japan & US as Mature Market to show the market volatility in China when index futures were introduced.

The Taiwan Index Futures Market's market liquidity and volatility were researched by Chou et al. (2017), and they discovered a substantial influence. The influence of futures trading on spot market volatility in Indian commodities derivatives markets was explored by Kumar (2017), and it was shown to be beneficial.

In the study of the SET50 index future, Chetchatree (2019) found a favorable correlation between futures trading activity and index price volatility. In a developing market dominated by individual investors, Li and Wang (2019) examined the link between daily institutional transactions and stock price volatility and discovered a large favorable influence.

These studies' inferences are varied, which might be attributed to differences in study methodology and market circumstances. However, the research repeatedly argues that there is a considerable correlation between futures trading and spot market volatility, with futures trade favorably affecting spot market volatility in a number of financial sectors. stock of each separately. The daily closing prices of cash market is taken from yahoo finance. To check the volatility in returns and market efficiency for each country the whole sample is divided into two main sections :(pre-year data and post year data). Table indicates the description of the data period respectively.

TABLE1: 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-86	1986-1990	1984-1990
US (Nasdaq)- mature market	1997-1999	Jun-99	1999-2003	1997-2003
Mexico (IPC Mexico)-emerging market	2015-2017	Jun-17	2017-2020	2015-2020
South Korea (KS11) -emerging market	2005-2007	Apr-07	2007-2010	2005-2010

Data Preprocessing: The collected data will be cleaned and preprocessed to handle any missing values, outliers, and other data issues. It will be important to ensure that the data is reliable and consistent before proceeding with the GARCH analysis.

4. METHODOLOGY

This comparative research intends to evaluate the effects of spot price volatility on stock index futures trading in both developed and developing markets. Secondary sources will be used to gather information on trade volumes, open interest, daily closing prices of stock index futures, and financial databases such as Yahoo Finance. For each market, the data will be examined independently using descriptive statistics, unit root analysis, and GARCH models appropriate for financial time series data.

5. RESULTS AND DISCUSSION:

UNIT ROOT ANALYSIS:
Unit root analysis is a statistical technique used to determine whether a time series data set is stationary or non-stationary. The Augmented Dickey-Fuller (ADF) test is a widely used unit root technique to assess the stationarity of time series data. When determining whether a time series variable is stationary or exhibits a unit root (non-stationary), the ADF test is used.

H0: The stock index series has a unit root and is non-stationary

H1: The stock index series does not have a unit root or is stationary

ADF Test Equation: $\Delta y(t) = \alpha + \beta t + \gamma y(t-1) + \Sigma \delta i \Delta y(t-i) + \varepsilon(t)$

Where: $\Delta y(t)$ represents the differenced time series data at time t. α is a constant term. β is the coefficient associated with a time trend, if present. γ is the coefficient of the lagged dependent variable, y(t-1). $\Sigma \delta i \Delta y(t-i)$ represents the sum of the coefficients of lagged differenced variables, where δi represents the coefficients and $\Delta y(t-i)$ represents the differenced values of the lagged variables

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

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

The table 2 shows that unit root analysis done on the stock market indexes of four different nations (Japan, US, Mexico, and South Korea) during two distinct time periods, denoted as "Pre" and "Post." The goal of the analysis is to assess whether or not the stock prices reflect a unit root process, a sign of a non-stationary time series.

The null hypothesis of a unit root is rejected for the Nikkei225 index of Japan because the ADF (Augmented Dickey-Fuller) test statistic is notably negative for both the "Pre" and "Post" eras. The Nikkei 225 index is therefore considered stationary during both timespans.

By contrast, the ADF test results that are not statistically negative suggest that the Nasdaq index of the US exhibits non-stationarity in both the "Pre" and "Post" eras. The Nasdaq index is assumed to demonstrate a unit root process and is consequently non-stationary because the null hypothesis was rejected in this situation

The ADF test data for the IPC Mexico index are not statistically negative, indicating non-stationarity for both time periods. As a result, it is determined that the IPC Mexico index is a non-stationary time series.

Whereas the KSII (South Korea) index displays stationary behavior both during the "Pre" and "Post" periods because the unit root process null hypothesis is rejected by the ADF test statistics, which are significantly negative.

Investors and decision-makers should consider the implications of these findings carefully. It is difficult to forecast future stock price movements since the presence of unit roots and non-stationarity in stock market indices suggests that the prices may be affected by long-term trends and may not revert to their mean over time.

Descriptive Statistics: Descriptive statistics such as mean, median, standard deviation, Minimum, Maximum, Skewness and Kurtosis will be calculated to provide an overview of the data and to identify any initial patterns or trends in the data.

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

The table 3 examines the performance of the Nikkei 225, Nasdaq, IPC Mexico, and KS11 stock market indexes in developed and developing markets before and after a certain time period. Their mean, median, lowest and maximum values as well as their standard deviation, skewness, and kurtosis are displayed. In comparison to the pre-period, the indexes exhibited greater mean values, wider ranges, and more volatility in the post-period. In the post-period, certain indices demonstrated a move towards less severe skewness and kurtosis.

In the post-period, the Nikkei 225 index had a higher mean and median in addition to a broader range and greater volatility. Its distribution was negatively skewed in both times, although the post-period's kurtosis was lower, suggesting fewer outliers.

The Nasdaq index had greater mean and median values, a substantially wider range, and more volatility in the post-period. Both of the eras' distributions were positively skewed, although the post-period's kurtosis was somewhat lower.

The Nikkei 225 index had a wider range, higher mean and median, and more volatility in the post-period. Although the post-period's kurtosis was lower and would have indicated fewer outliers, its distribution was negatively skewed in both periods. In the post-period, the Nasdaq index displayed higher mean and median values, a much broader range, and more volatility. Although the post-period's kurtosis was a little bit lower, the distributions of both periods were favorably skewed.

In both the pre- and post-periods, the IPC Mexico index had a comparable mean and median with a very small range. The distribution remained negatively skewed but with significantly reduced skewness in the post-period, and volatility rose. Indicating a distribution with fewer outliers, the kurtosis shrank.

In the post-period, the KS11 index had a higher mean and median combined with a wider range and greater volatility.It had an exceptionally heavy tail, significantly negatively skewed distribution, and several outliers in both time periods. Even while the kurtosis was lower in the post-period, it was still rather high.

Changes in the indexes for mature and emerging markets. The mean and median values increased generally over the post-period, showing improved market performance. The ranges widened to reflect increased market turbulence. The Nasdaq index saw the largest growth in range and volatility as well as the greatest increase in mean and median values. Although there was a tendency towards less severe skewness, the distributions in the post-period remained skewed. Generally speaking, the kurtosis values dropped, showing distributions with comparatively fewer outliers. According to these results, the post-period saw an increase in market volatility, a more even distribution of stock market returns, and overall positive market growth.

GARCH Analysis: In order to assess the impact of futures introduction on volatility, it is common to compare the volatility levels before and after the introduction of stock index futures. Previous studies have often employed the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, which is suitable for analyzing stock market data. The GARCH model allows for precise specification of volatility and provides controls for other factors that can influence volatility.

The main hypothesis in this study can be formulated as follows:

H0: There is a change in the volatility of the stock index after the introduction of index futures.

H1: There is no change in volatility after the introduction of index futures.

Garch Model: $\sigma_t = \alpha + \beta\sigma_{t-1} + \gamma\varepsilon_{t-1}^2$

where:

σ_t is the volatility at time t

α is the constant term

β is the autoregressive coefficient

γ is the conditional variance coefficient

ε_{t-1} is the white noise error term at time t−1

By analyzing the data using the GARCH model, the study aims to determine whether the introduction of stock index futures has a significant impact on the volatility of the underlying stock index. The GARCH model can capture the dynamics of volatility over time, allowing for the examination of any shifts or changes in volatility patterns associated with the introduction of futures trading.

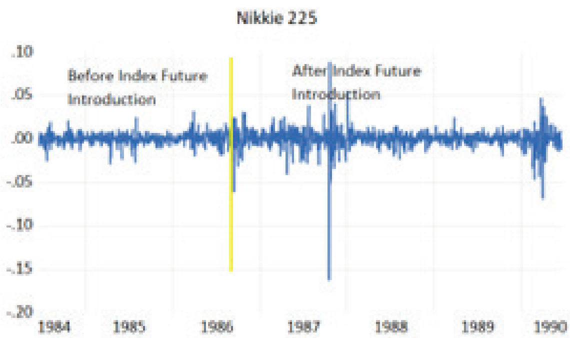

Figure 1

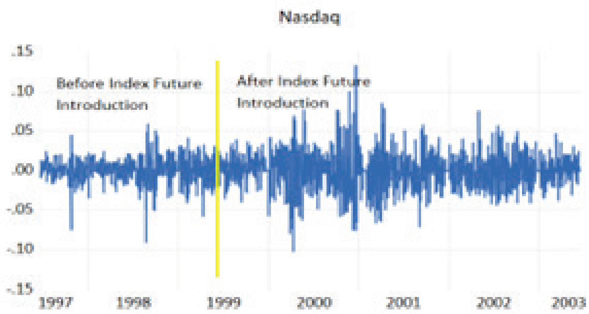

Figure 2

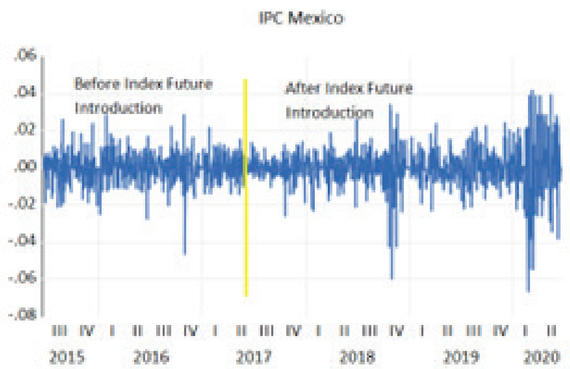

Figure 3

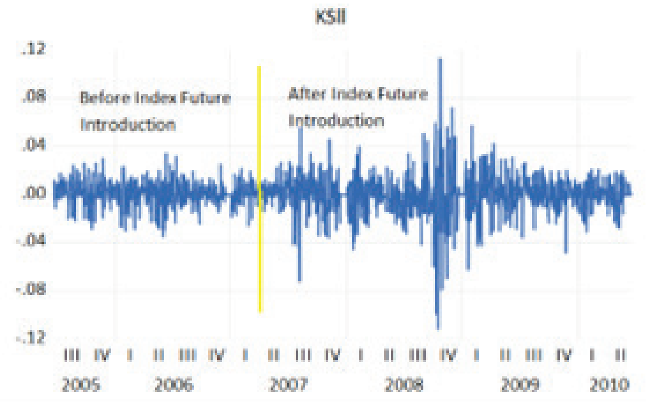

Figure 4

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
Nasdaq	0.981469	0.000769	0.082504	0.898196	4.524	0
IPC Mexico	0.976311	0.000042	0.194471	0.781798	8.016	0
KSll	0.984755	0.000838	0.101099	0.882818	7.153	0

The spot volatility of the Nikkei 225, which represents Japan in the mature market segment, was 0.884379 prior to the introduction of index futures and 0.953809 following it. This suggests that the developed Japanese market is experiencing moderate to high levels of volatility. The rise in spot volatility following the launch of index futures shows that the market's volatility rose, possibly as a result of increased trading activity and modifications to the market's dynamics.

Before the introduction of index futures, the spot volatility on the Nasdaq, which represents the US market, was 0.968063; after the introduction, it was 0.981469. These numbers show that the mature US market has a comparatively high amount of volatility. The minor boost in spot volatility following the introduction is likely caused by a number of variables unique to the developed US market.

The IPC Mexico showed spot volatility of 0.696361 prior to the introduction of index futures and 0.976311 following the introduction in the emerging market category. This suggests that volatility has significantly increased since index futures were introduced in the developing Mexican market. The influence of index futures on trade dynamics and market participation can be explained by the higher spot volatility, which indicates that the market became more erratic.

Finally, the spot volatility of the KS11, which represents the South Korean market, was 0.937678 before the introduction of index futures and 0.984755 after. These numbers point to a moderate

to high level of market volatility in South Korea's developing economy. The market may have become more volatile as a result of characteristics unique to the context of emerging markets, as evidenced by the rise in spot volatility following the introduction.

Variable levels of volatility are found in both mature and emerging markets, according to the spot volatility research. The Nasdaq and Nikkei 225, which are mature markets, have considerably higher spot volatilities than other markets because of their inherent volatility and trading dynamics. On the other hand, spot volatility is less extreme but nevertheless present in the emerging markets of South Korea (KS11) and Mexico (IPC Mexico). The introduction of index futures in these developing markets seems to have significantly boosted spot volatility and its levels.

6. CONCLUSION

The influence of spot price volatility on the trading of stock index futures in Japan, the US, Mexico, and South Korea was examined using a GARCH model in the study. The introduction of index futures has different effects on volatility in both developed and emerging markets, according to the results. The necessity for market participants and regulators to address increased volatility in their decision-making and risk management techniques is one of the practical ramifications. To fully comprehend the function of financial derivatives in markets, future research should examine long-term consequences, market dynamics, and the impact of stock index futures on other market components.

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