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Positive Affect of Financial Derivatives on The Stock Market

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Abstract. The derivatives market is widely recognized in financial markets, and it has developed rapidly, but there is little evidence that it contributed to the development of financial and economic markets. This article investigates the dynamic relationship between the Indian derivatives market and the stock market to determine how it affects market pricing. This paper use the DCC-garCH model to examine the dynamics of India from the third quarter of 2018 to 2022, I find that the financial derivatives market is more financially contagious than the equity market. Therefore, I can analyse that the development of derivatives has a positive impact on economic growth.

Keywords: financial derivatives, DCC-garCH model, india stock market

1. Introduction

Finance has become increasingly more complicated with the rise of financial derivatives and empirical finance in recent years. However, derivatives still represent a danger to the market. Stock prices may rise or fall sharply because of the implementation of financial derivatives, thereby increasing market risk. According to Lau it was found that the Malaysian capital market imposed a "discount" on users of derivatives, indicating that the utilization of derivatives was negatively correlated with the company's market worth [1].

Vahey and Oppenheimer believe that financial derivatives may either raise or lower stock market risk [2]. They claim that stock options may be utilised to manipulate the market. Moreover, Shiu examined the regulatory return data of UK non-life insurance companies from 1994 to 2011 and found that the use of more reinsurance would have a negative impact on insurance companies, while those insurance companies inclined to risk management tended to employ both reinsurance and derivatives [3]. This reveals a relationship between business results, reinsurance and derivative use. Furthermore, financial derivatives have the potential to enhance the underlying market's efficiency [4]. Financial derivatives may have a substantial impact on the expansion of global economic goods, according to extensive theoretical analysis. There are several ways in which the market for derivatives may help stabilise the efficiency of the financial system by increasing risk activities and using various derivatives kinds to accomplish hedging. Investors in hedged notes, for example, use derivatives to protect themselves against market volatility. Kim et al. found that the adoption of derivatives by local enterprises and domestic multinationals is a value-creating activity [5]. Emerging markets and the growth of derivatives markets are considered in Atilgan et al. [6]. As part of his research into derivatives markets, he has also examined market structure via literature and theory, recognizing the significance of price discovery.

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The risk may be quantified using the essential, unobserved volatility component proposed by Hwang and Satchell [7]. According to their observations, the methodology is used to evaluate whether derivatives markets pose a threat to the stability of capital markets. Kassi et al. demonstrated that diverse market hazard measures had such negative influence on the company's economic profitability by employing OLS, fixed effects, random effects, differential GMM, and systematic GMM models. Financial derivatives drive the favorable impact on the equity system in a variety of ways, as shown by the perspectives mentioned above and actual study findings [8]. However, further research has shown that financial derivatives may impact the stock market's price in its market. However, there is relatively limited literature on how derivatives affect the stock market's pricing.

According to Vo and others, the CIJU nations include China, India, Japan, and the United States, which have significant derivatives markets [9].

By statistical analysis from India, a country with a well-developed derivatives market, I evaluate the relationship between the development of derivatives markets and stock markets. Statistical and mathematical econometrics models are used to further illustrate the financial market effect of derivatives markets. I aim to assist investors in better recognizing the association between the derivatives market and the stock exchange. They may utilize derivatives more effectively in order to enhance their economic expansion.

2. Literature Review

This research is the most critical explanation for the prevalence of hedging strategies. Economics may benefit from using derivatives. Wang also uses the informativeness of bank variables through an OLS model that highlight indirectly the value of derivatives, giving something beyond profits and book value [10]. She also investigated that it is also conceivable to mitigate the knowledge disparity across executives and economic condition by hedging with derivatives. Hedging minimizes data redundancy, which might diminish brokerage and raise the sale price of the hedger's stock closer to its underlying value [5,11,12,13].

Observable fundamental components of volatility, as postulated by Hwang and Satchell, could be used to evaluate risk [7]. It employs a stochastic volatility model, which strengthens the relevance of the underlying volatility indicator compared to the DCC-MGARCH approach. If financial derivatives disturb the equilibrium of asset markets and undermine market efficiency, this method is more suited. There is a DCC-MgarCH approach implemented by Roy and Roy in 2017. This method demonstrates that the stock market's effects on financial derivatives are the most important. Whenever the model evaluates the observable connections across stock markets, it arises with directed consequences. This model concludes that financial derivatives have a substantial influence on the stock market by evaluating financial contagion and spillover effects between financial derivatives markets and other markets. Consequently, during a financial crisis, substantial price swings in derivatives have more decisive influence on market stability. The connection between the two stock markets is complicated.

Since the OLS model is a single variable model that makes it easier for the researcher to approximate the best set of data through analysis and exclusion, the DCC-MgarCH model differs from the OLS model. Both approaches research data by random sampling and the OSL model to describe a precise relationship. The DCC-MgarCH model, is a multivariate version. The volatility of the dynamic correlation between two series may be explored, which indicates that the volatility between them is not a constant, but instead a coefficient that changes with time. Results from the DCC-MgarCH model, and those from the OLS model, are more relevant to the real world.

Ahelegbey et al. established the Network Volatility Index (NetVIX) to evaluate market volatility. Indicators of market volatility are provided by the index [14]. Indexes like these may be used to assess the financial markets overall condition and gather extensive data for research into how market analysis affects the markets.

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3. Methodologies

3.1. The Data and Method

My data is from the reserve bank of India, which includes monthly and annual averages of BSE 100 from 2015 to 2016, and National Stock Exchange of India Limited Index Futures and Stock Options. All data are collected from the published statement by India bank on September 15, 2021. The information in table 2 serves as the primary variable in this model calculation. By calculating their respective logarithms and determining the best order if ARCH effects are present, the garch model may be built.

Dynamic analysis using the DCC-garCH model

Firstly, I take the series logarithmically, because some time series about the economy are not smooth. Only smooth time series I can model on this basis. In order to make the non-smooth time series smooth, I usually take the logarithmic rate of return of the series and differentially process it to make the series smooth. Secondly, I try to build the arch model and perform the arch effect test on the residuals. Then I make univariate DCC-garch model after confirming the arch effect, i.e. garch (1,1) model. Finally, do the dcc model, when the value of α+β is less than 1, the model is available.

ε_i assume $\varepsilon_t = \sigma_t z_t$, and $z_t \sim iidN(0,1)$

Then I can write σ_t^2 as

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \cdots + \alpha_q \varepsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \cdots + \beta_p \sigma_{t-p}^2 \quad (1,1)$$

$\alpha_0 > 0, \alpha_i \geq 0, i > 0$ Returns for each period are linearly combined in a non-negative manner with a positive constant term.

$$r_t = u_t + p_t{}' p_t \sim N(0, H_t) z \quad (2)$$

$$H_t = D_t R_t D_t \quad (3)$$

$$R_t = (I \Theta Q_t)^{-\frac{1}{2}} Q_t (I \Theta Q_t)^{-\frac{1}{2}} \quad (4)$$

$$Q_t = (1 - a - b)Q + \alpha \varepsilon_{t-1} \varepsilon_{ti1} + b Q_{t-1} \varepsilon_t = D_t^1 \rho_t \quad (5)$$

D_t is the k*k diagonal matrix formed by taking the diagonal elements of the time-varying conditional standard deviation derived from the univariate GARCH model; R_t is the dynamic conditional correlation coefficient moment; Q_t is the unconditional correlation matrix of the normalized residuals; ε_t is the vector normalized residuals; α is the standardized unconditional covariance coefficient ; b is the conditional covariance matrix coefficients

(5) equation is the covariance of the target variance

The DCC- GARCH model is built on the basis of the GARCH (1) structure

$$q_{i,j,t} = \rho_{i,j} + \alpha\left(\varepsilon_{i,t-1}\varepsilon_{j,t-1} - \rho_{i,j}\right) + \beta(q_{i,j,t-1} - \rho_{i,j}) \quad (6)$$

Is the related coefficient between the gold price yet its influencing factors, and also the standardized q

The DCC-Garch (1,1) model $(\alpha + \beta < 1)$ satisfies the mean reversion phenomenon, then it is consistent with the actual.

It can be written as

$$Q_t = \left(1 - \lambda\right)\left(\varepsilon_{t-1}\varepsilon_{t-1}\right) + \lambda Q_{t-1} \quad (7)$$

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$$Q_t = S(1 - \alpha - \beta) + \alpha(\varepsilon_{t-1}\varepsilon_{t-1}) + \beta Q_{t-1} \quad (8)$$

Based on calculations from the DCC-garCH model, I find the dynamic nature of the link between derivatives market development and economic growth.

I use the information shown in Tables 1 and 2, where a arch test is performed on the unit-root provided in columns 6 and 9 of Table 2, and the results are shown in Table 3 and 4.

DCC-garch model testing is used to demonstrate the dynamic link between derivatives and economic market development. Our data seem to confirm the hypothesis of Vo [9]. Tables 5 and 6 show a strong correlation between economic growth in India and the development of derivatives markets. Hence, the Indian market appears to benefit from the development of financial markets.

Table 1: Monthly and annual average of BSE 100 in India.

TABLE 180: MONTHLY AND ANNUAL AVERAGES OF BSE 100(Base:1983-84=58)													
Year/ Month	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
2015-16	8659.67	8430.55	8291.26	8595.19	8455.80	7946.28	8297.97	8025.41	7947.01	7666.63	7283.23	7640.84	8105.72
2016-17	7898.73	7994.18	8310.40	8684.44	8864.82	9023.60	8954.21	8493.52	8340.65	8640.63	9114.03	9346.61	8638.30
2017-18	9561.06	9780.49	9931.57	10203.09	10275.10	10387.32	10547.05	10782.64	10800.70	11257.83	10909.85	10596.83	11424.72
2018-19	10882.24	10996.62	11038.23	11237.63	11786.67	11571.01	10614.98	10890.79	11049.02	11074.03	11008.27	11511.52	11131.36
2019-20	11837.69	11698.37	11946.59	11632.85	11073.90	11251.34	11586.15	12055.25	12152.92	12284.90	12045.66	9515.62	11592.74
2020-21	9179.61	9305.87	11028.65	10966.60	11437.68	11456.41	11859.30	12668.09	13674.19	14449.11	15111.60	15018.34	12134.05
2021-22	14801.36	15229.82	16014.20	16098.93	-	-	-	-	-	-	-	-	-

Note: The average are based on daily closing index.
Source: BSE Ltd.

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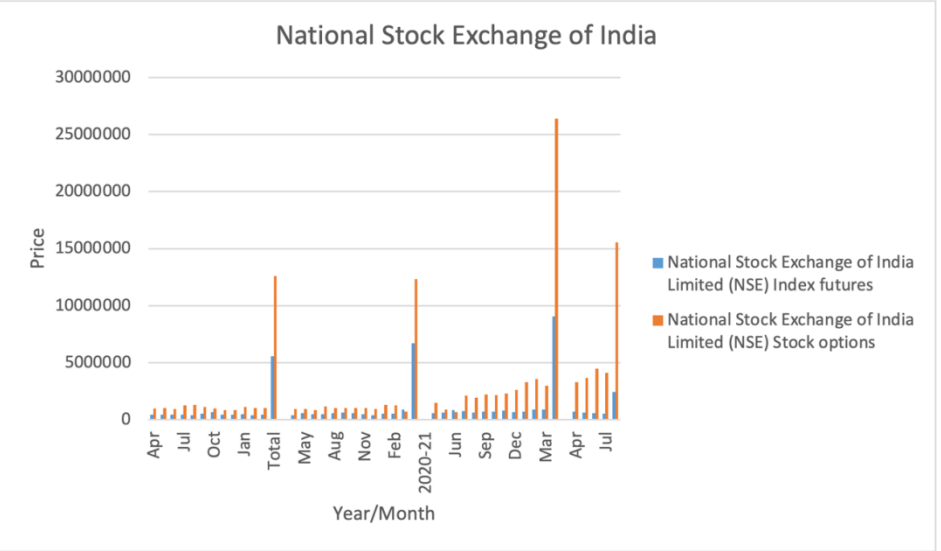
Table 2: Collect from the table of turnover in the equity derivatives market in India by column 6 and 9.



3.2. Results

I use the data from Table 2 in column 6 to make the arch test and apply the data in DCC-garCH model, the result shows at Table 3 and Table 4.

Furthermore, I can follow the same steps by using the column 9 data. The result will shows in table 5 and Table 6.

The data exhibit an arch effect, which indicates that I can create a garch model to continue data analysis, according to the results. Tables 7 and 9 allow me to draw the conclusion that there is positive dynamic correlation fluctuation between them all. This outcome can also support the notion that derivatives have a beneficial effect on the stock market, which I indicated before.

Table 3: Arch test for column 6.

Source	SS	df	MS	Number of obs	=	43
				F(0, 42)	=	0.00
Model	0	0	.	Prob > F	=	.
Residual	2.6326e+14	42	6.2680e+12	R-squared	=	0.0000
				Adj R-squared	=	0.0000
Total	2.6326e+14	42	6.2680e+12	Root MSE	=	2.5e+06

dv1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_cons	46339.814	3.82e+05	0.12	0.904	-7.24e+05	8.17e+05

. archlm,lag(1/3)

LM test for autoregressive conditional heteroskedasticity (ARCH)

lags(p)	chi2	df	Prob > chi2
1	7.669	1	0.0056
2	12.754	2	0.0017
3	13.114	3	0.0044

H0: no ARCH effects vs. H1: ARCH(p) disturbance

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Table 4: DCC-garCH result for lcolumn 6.

```
.   regress dv2
```

Source	SS	df	MS	Number of obs	=	43
				F(0, 42)	=	0.00
Model	0	0	.	Prob > F	=	.
Residual	1.7303e+15	42	4.1198e+13	R-squared	=	0.0000
				Adj R-squared	=	0.0000
Total	1.7303e+15	42	4.1198e+13	Root MSE	=	6.4e+06

dv2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_cons	3.38e+05	9.79e+05	0.35	0.732	-1.64e+06	2.31e+06

```
.    archlm,lag(1/3)
LM test for autoregressive conditional heteroskedasticity (ARCH)
```

lags(*p*)	chi2	df	Prob > chi2
1	8.078	1	0.0045
2	12.713	2	0.0017
3	13.262	3	0.0041

H0: no ARCH effects *vs.* H1: ARCH(*p*) disturbance

Table 5: Arch test for column 9.

```
Dynamic conditional correlation MGARCH model

Sample: 2 - 44                                  Number of obs   =        43
Distribution: Gaussian                          Wald chi2(.)    =         .
Log likelihood = -685.0613                      Prob > chi2     =         .
convergence not achieved
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dv1						
_cons	40633.961	.	.	.	.	.
ARCH_dv1						
arch						
L1.	0.445	0.073	6.13	0.000	0.303	0.588
garch						
L1.	-0.198	0.034	-5.76	0.000	-0.265	-0.131
_cons	6.01e+12	.	.	.	.	.

```
.
end of do-file
```

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Table 6: DCC-gatCH result for column 9.

Dynamic conditional correlation MGARCH model

Sample: 2 - 44 Number of obs = 43
Distribution: Gaussian Wald chi2(.) = .
Log likelihood = -724.2016 Prob > chi2 = .
convergence not achieved

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dv2						
_cons	8.54e+05	.	.	.	.	.
ARCH_dv2						
arch						
L1.	0.330	.	.	.	.	.
garch						
L1.	-0.225	0.000	-2.2e+04	0.000	-0.225	-0.225
_cons	4.16e+13	.	.	.	.	.

.
end of do-file

4. Conclusion

A considerable influence on the financial markets is exerted by the establishment of the economic sector. In order to help the actual economic growth, it is a critical component of the national capital market. In addition, it has the potential to stabilize the capital market and improve market efficiency, both of which have a direct impact on the actual economy. Derivatives have been shown to have a positive impact on economic commodities by acting as a hedging tool to stabilize market efficiency. However, there is insufficient evidence to support this research's claim.

I analysis the vibrant return interaction between the derivatives and equity operations. I used the DCC-garCH model to examine data from the third quarter of each year from 2018 through 2022 in India, a country with an established derivatives market. There is noticeable volatility in the development of the Indian economic condition, which has an influence on economic growth.

The limitation of this paper is that I only use a DCC-garCH model to evaluate the data on the expansion of the derivatives system in India, which only demonstrates that the turbulence of the share market is more apparently. I can further analyze this result and use other models for risk description and risk management.

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