Dynamic Volatility Persistence of Islamic Equity Mutual Fund of Islamic Funds Markets

Ghulam Nabi*[a], Rameez ur Rehman[b], Rizwan Ali[a]

[a]University of the Punjab, Lahore

[b]The Lahore University, Lahore

Corresponding address: gnabi.stat@pu.edu.pk

Abstract

This study examines the volatility of equity fund's return. It also determines the return volatility persistence and asymmetries in return volatility using data from Saudi Arabia, Malaysian, and Pakistani equity funds from 2010 to 2022. This study uses different GARCH variants for symmetric and asymmetric volatility behaviours to examine volatility dynamics. A News Impact Curve is used in this study to analyze the asymmetries in the volatility of investment returns and the relative value of equity funds markets across the various countries included in the study. Based on the study's results, daily returns exhibit persistent volatility. Still, weekly and monthly returns are unsuitable for the GARCH family, as the ARCH effect could not be found in less frequent data and does not appear to have persistent volatility. Daily returns also show asymmetries, indicating that investors' perceptions and actions are affected directly by news arriving consistently in the market. In contrast, the spectacle recedes with extended periods, suggesting that the emerging Islamic market can behave semi-strongly during prolonged periods. These findings impact investing in assets, pricing instruments, estimating the cost of capital, and optimizing portfolios.

Keywords: Mutual funds, volatility, ARCH, GARCH, volatility persistence, News Impact Curve

Introduction

It is easy to distinguish emerging and developed markets by their characteristics (Umar et al., 2022). There is a high reliance on a few sectors in most emerging markets and a low per capita income (Suet al., 2020). Numerous factors contribute to turbulent economic growth, including political instability, suddenly changing regimes, the uncertainty of exchange rates, Price changes resulting from exogenous factors, and so on (Umar et al., 2022). Furthermore, instability exists in the financial system due to constrictions on information asymmetry, investment volumes, and liquidity restrictions (Teplova & Tomtosov, 2021; Umar et al., 2022). As a result,

debt instruments are limited in their advancement, and the responsibility for business financing falls primarily on equity fund markets, making them a critical source of economic and business growth (Mirza et al., 2022). Various risk premiums are associated with emerging markets, and their risk premiums are based on variations in equity returns (Rizvi et al., 2021). A variation in this parameter can affect a portfolio's selection process and asset management.

As a result of frequent volatility changes, investors are also plagued with higher capital costs and less attractive investment opportunities (Su et al., 2021; Umar et al., 2022). Hedging strategies and pricing of derivatives are also dependent on this information. The volatility dynamics are affected by shocks and evolve (Jawadi et al., 2021). This transformation may develop more profoundly in emerging markets since they are naturally turbulent (Fenner et al., 2020; Umer et al., 2022).

The volatile dynamics of emerging Islamic economies must be understood for these reasons. Furthermore, conventional or any market findings cannot be generalized to Islamic or another market, especially in the emerging Islamic market, particularly with very different volatility structures. Pakistan has a market capitalization of approximately US$ 52 bln. Stock Exchange (PXS) and roughly $2,888 bln of Saudi Arabia Stock Exchange (Tadawul), the biggest stock exchange in South Asia and GCC. Over the past five years, significant foreign portfolio investment has been made in Pakistan and Saudi Arabia. It has often been one of the fastest-growing emerging markets. The P/E of 9.2 represents the Pakistan Stock Exchange, and 13.9 offers attractive valuations for Saudi Arabia's representative value to portfolio managers worldwide. However, no prior study has comprehensively examined Pakistan and Saudi Arabia's volatility dynamics concerning markets and Islamic equity funds. Most academic studies only involved the Pakistan Stock Exchange and Saudi Stock Exchange, considered asset pricing propositions and political factors, and ignored equity funds (Tissaoui et al. 2021;). Islamic equity funds are completely ignored concerning the market volatility structure. Among the authors (Ji et al., 2021) who struggled to identify the finest volatility structure for forecasting when higher moments were present, only one attempted to do so but did not consider the effects of new information on volatility.

Different equity funds and market index frequency representations are analyzed using symmetric and asymmetric GARCH models. Based on the framework presented by (Maheu et al., 2021), the study suggests associated news impact curves on Islamic equity funds and the stock market index of the related Islamic emerging markets. There are several advantages to GARCH over ARCH. ARCH is limited to only two parameters, while GARCH can account for an unlimited number of past squared errors. The primary limitation of this GARCH model is that as it is symmetric by

default, it can respond equally well to good and bad shocks. An asymmetric GARCH model would be more suitable to simulate these effects since the study will separately demonstrate the impact of good and bad shocks (news). Nelson (1991) proposed the EGARCH model, and Glosten et al. (1993) proposed the GJR model as an asymmetric GARCH model.

Using the EGARCH model to capture both shocks' positive and negative effects is also possible. If GARCH parameters were to be expressed using a log (as opposed to a positive log), in this way, their parameters would no longer be artificially restricted to the negative. An extra independent variable is included to correct for possible asymmetries between the leverage effects and the regression coefficients in the GJR-GARCH model, an extension of the original GARCH model. The third variable results from an interaction between the lagged error squared and the sign dummy of the lagged error, which resides at 1 for negative values and 0 for positive values for the lagged error. Thus, it will consider that a negative shock could have a negative impact on the economy.

There is a significant research gap in equity funds concerning the stock market because volatility responds to shocks (good and bad). In this study, we examine how volatility develops dynamically by examining how news impacts volatility dynamics in the Islamic equity funds market and stock market of selected Islamic countries. Based on the study's results, daily returns exhibit persistent volatility. Still, weekly and monthly returns are unsuitable for the GARCH family, as the ARCH effect could not be found in less frequent data and does not appear to have persistent volatility. Daily returns also show asymmetries, indicating that investors' perceptions and actions are affected directly by news arriving consistently in the market. In contrast, the spectacle recedes with extended periods, revealing that the emerging Islamic market can behave semi-strongly during prolonged periods. These findings impact investing in assets, pricing instruments, estimating the cost of capital, and optimizing portfolios.

In the following sections, we will proceed with the remaining parts of the paper. Section 2 summarizes the related literature. We describe our data and methodology in Section 3 used in this study. Section 4 explains the empirical findings and discussion. The last section, 5, concludes the article.

Literature Review

A price's volatility, which measures how much a price changes over time, is often used as a proxy for financial risk. Several dynamic measures in the literature include standard deviations of stock returns. To appropriately capture volatility changes, the

conditional heteroscedasticity of the data is taken into account while allowing volatility to vary over time (Engle, 1982). The value of volatility timing in terms of short-term investors was assessed using conditional mean-variance analysis by Fleming et al. (2001). Unlike static portfolios with the same expected returns and volatility target, volatility timing strategies outperformed unconditionally efficient, fixed portfolios. As volatility affects investment decisions, pricing, securities valuation, risk management, and monetary policy, assessing volatility changes is one of the most critical challenges in financial markets. The recent global financial crisis of 2008–2009 showed significant increases and changes in stock, bond, currency, commodity, and derivative volatility (Białkowski Dang & Wei, 2022). In light of this, volatility modeling has become increasingly important. In addition to the crisis that plagued the financial system and the economy in 2007, excess volatility was also responsible for the economic downturn. Volatility persistence should be investigated to understand how shocks propagate and how the crisis and economic downturn are linked.

Since volatility persists over time, stock market returns are relatively predictable. The return on stocks, on the other hand, is somewhat unpredictable. Recent research results generally indicate that mutual fund managers cannot predict market reversals but can accurately predict market volatility. There is evidence that fund managers' compensation incentives play a significant role in determining their volatility timing. After adjusting for fund styles and flows, it remains consistent that fees correlate with volatility timing. Busse (1999) recommends timing counter-cyclically when studying mutual funds' duration and volatility timing. Over 80% of the funds he studied from 1985 to 1995 timed volatility counter-cyclically. Consequently, when market conditions become more volatile (less volatile), fund betas tend to decrease (increase).

Giambona and Golec (2009) extend Busse's model to include fund compensation explicitly as an influence on volatility timing, and their results are discussed. According to their study, fund volatility timing significantly affects fund returns with a much larger sample size (3696 funds) and a much longer sample span (1960–2002) than Busse's. Countercyclical timing funds form a more even distribution among procyclical and countercyclical timing funds in their model. The timing of flow and volatility varies depending on the funds used to calculate aggregate fund flows at a particular time. The timing of market volatility by fund managers is influenced by compensation incentives (Giambona & Golec, 2009). When considering volatility timing, it is less countercyclical or more procyclical with higher incentive

management fees. When fund styles and aggregate fund flows are controlled, the relationship between prices and volatility timing persists; therefore, if they account for them, they still find a relationship. The procyclical timing of volatility and flow is linked to a less aggressive fund style if volatility timing is unfavorable. An investment's average excess return, Sharpe ratio, and alpha improve when procyclical.

Kim and In (2012) controlled the false discovery rate concerning volatility timing in U.S. mutual funds to determine the number of countercyclical (procyclical) timing funds. They found that the proportion of procyclical and countercyclical volatility timing funds across their sample funds was about equal. However, the results show that counting significant positive (negative) timing coefficients was still reasonably accurate using the standard approach, despite the absence of false discoveries in volatility timing. Furthermore, the researchers found that a portfolio of a procyclical timing fund was more likely to outperform a countercyclical timing fund with equally weighted performance measures, as compared to both types of portfolio. As expected, procyclical timers take on more risk, leading to their expectation that they will be able to generate greater returns as a result. The procyclical timing portfolio, however, outperformed the countercyclical timing portfolio on an out-of-sample basis because its timing is different from its counterpart.

Clements and Silvennoinen (2013) looked at predicting optimal portfolio weights for a volatility timing strategy. The paper estimated the economic value of optimal portfolio-building methods based on realized volatility. Traditionally, portfolios are formed by forecasting the covariance matrix based on econometric models. The forecasts are made based on simple historical averages and those derived from econometric models. They also proposed an optimal portfolio weight calculation method, using realized volatility and direct forecasts to construct a time series of portfolio weights. There is merit to several naive forecasts and a direct forecasting approach. As a result, portfolios produced by this approach are similar to many competing systems and more stable over time. These findings are an obvious consequence of how volatility timing may be implemented in portfolio allocation. The investment performance of a portfolio manager engaged in market timing was examined by Ferson and Mo (2015) when analyzing the market level and volatility timing behaviors and the security selection ability of the manager. They could accommodate all three of these components throughout their development and implementation of measures. It is very well defined that the sum of three abilities measures performance. Upon evaluating the criteria of active U.S. mutual funds, the researchers concluded that the measure did not indicate investment ability at a broad group level for any of the mutual funds when expense ratios were adjusted to take

into account market levels and volatility timing to sort fund performance, return gaps, active share, or turnover.

The volatility of past returns is one of the most potent predictors of future performance in mutual funds. Jordan and Riley (2015) compared U.S. equity fund returns using the Fama-French four-factor model to determine the alphas for low-and high-volatility funds. The researchers found that once heterogeneity in fund characteristics was controlled, an increase in fund volatility of one standard deviation would predict an overall 1.0% decrease in fund alpha the following year. According to them, fund volatility does not relate to a fund's performance because of fund manager skills. According to their findings, the volatility anomaly adversely affects mutual fund returns. To compare the returns of low versus high volatility stocks, they develop a new pricing factor, LVH (low volatility versus high volatility). This factor reduced the alpha of low-volatility and high-volatility mutual funds by zero when incorporating it into the Fama and French four-factor model. In addition, they showed that both low and high-volatility funds respond equally well to a recent explanation for the vol anomaly. The vol anomaly is suspected to be caused by small, low-profitability growth stocks, according to Fama and French (2014) and Novy-Marx (2014). Adding the profitability and investment factors to Fama and French's (2015) four-factor model doesn't result in any alpha for low-volatility and high-volatility mutual funds. Profitability and investment factors can provide explanations for anomalies that do not relate to volatility. According to Jordan and Riley (2015), a significant and widespread vol anomaly affects mutual fund returns strongly. As a result of the vol anomaly's significance, a failure to take it into account leads to substantial errors in assessing fund manager skills. It is also possible to correct skill mismeasurement created by the vol anomaly through factors not directly associated with volatility.

An evaluation of volatility dynamics in Gulf Cooperation Council countries (GCCs) during calm and crisis periods was conducted by Fakhfekh et al. (2016). An empirical study of volatility persistence uses the FIEGARCH model (Fractionally Integrated Exponential Generalized Auto-Regressive Conditional Heteroscedasticity). Volatility dynamics can be reproduced using this specification, which directly measures volatility dependence over time. According to their findings, volatility exhibits asymmetry since bad news often impacts volatility more than good news. Furthermore, conventional banks appear to be more volatile following a shock than Islamic banks, as they are more vulnerable to bad news. In contrast to traditional banks, Islamic banks are somewhat more resilient because the degree of resilience varies with the sample.

Several reasons for the interest in investigating volatility in the mutual fund industry are discussed by Foran and O'Sullivan (2017). First, According to the literature, compensation incentives influence risk choices among fund managers. Specifically, they examined whether managers can time market volatility conditions for stock selection and asset allocation decisions. Second, investor redemptions are more likely to occur during periods of high market volatility. Finally, It is also important to mention that fund managers try to time market volatility even if their stock returns don't persist, which rationalizes these attempts. After worsening volatility conditions post-2008 crisis, billions of dollars have been wiped from global stock markets, demonstrating the value of timing these conditions. A small percentage of U.K. equity mutual funds showed evidence of skilled volatility timing as the systematic risk decreases when conditional market volatility exceeds normal. There is a strong correlation between the prevalence of market liquidity timing and most volatility timing. According to the study, funds tend to forecast market volatility better than they do market returns. However, it is unclear if there is persistent evidence of both timing and persistence of market volatility. Although both market volatility and overall market volatility appear persistent, it does not explain the phenomenon.

According to Cederburg et al. (2020), volatile-managed portfolios improve real-time investors' returns using 103 equity strategies. When directly compared, there is no systematic difference between volatile-managed and unmanaged portfolios. Moreira and Muir (2017) state that volatility-managed portfolios show significant positive alphas. The unmanaged portfolio produced lower certainty equivalent returns and Sharpe ratios compared with an excellent out-of-sample version of these regressions. Still, the trading strategies derived from them are not implausible in real-time. Volatility-managed portfolios out of sample perform poorly primarily because of structural instability in their underlying spanning regressions.

Islamic Portfolio Volatility

Investing in Islamic equities has recently attracted much research, including ours. Islamic investments have been demonstrated to provide investors with additional diversification benefits. According to the decoupling hypothesis, Shariah compliance stocks are unique investments that differ from conventional equity investments. Investing in Islamic equities funds is a specific investment vehicle from mainstream equity investing since sector filters and financial ratio screening distinguish it from mainstream equity investing. Portfolios of unscreened stocks have risk profiles substantially different from those of portfolios of mainstream equities. Income from investments in such an asset class cannot be compared with earnings from mainstream equities funds. This assertion would suggest that Islamic equities funds

offer additional diversification opportunities for investors. The following empirical articles provide evidence that either supports or opposes this theory of decoupling based on empirical data.

Balcılar, Demirer, and Hammoudeh (2015) found that Shari'ah-compliant equity sectors contribute significantly to international diversification. Consumer services, oil & gas, and technology sectors may benefit from a haven effect during periods of the economic downturn due to their negative risk exposure. According to Majdoub and Mansour (2014), a spillover effect from American equity markets into Islamic shares does not exist over time, and the U.S. and Islamic equity markets are weakly correlated. Islamic finance strongly emphasizes linking the fundamental and financial sectors, which the authors attribute to, among other factors. A US-based investor investing in Islamic equity doesn't gain additional diversification advantages (Saiti, Bacha, & Masih, 2014). Still, they can provide diversification benefits to investors in various Islamic and non-Islamic countries. Abbotts and Trichilli (2015) reached similar conclusions in their empirical study of emerging markets. In a survey conducted by Mensi et al. (2015), they demonstrate how emerging Islamic equity markets can reduce downside risk and provide diversification to secular investors during quiet and downturn periods. According to the authors, Islamic equities are a better investment option than gold.

A foreign shock to an Islamic portfolio in the West is less likely to affect it than a shock from within the region (Dewandaru et al. 2014b). Their rationalization of this duality in exposure is that lower exposure is due to lower leverage. A higher exposure in comparison is due to less diversification in the portfolio and greater concentration in a few sectors. It is generally assumed that Islamic screening norms will exclude companies providing financial services from the Islamic market. This was one of the reasons that the recent subprime crisis was less damaging for Islamic markets. Especially in Asia-Pacific, Islamic markets have experienced long periods of volatility due to economic and trade ties. Several recommendations are offered by the authors based on their empirical findings. To effectively diversify a portfolio using Islamic equities, it is necessary to anticipate the source of shocks and determine whether internal or external diversification is the best approach. Islamic investors primarily focus their portfolios on fewer sectors, so they need to understand why crises occur. Investing in Islamic equities provides third-party investors with the benefit of being less susceptible to financial leverage, a desirable hedge for those accustomed to high-leverage investments. The fourth factor is that Islamic markets constitute a large portion of today's emerging markets geographically, which could

effectively replace the allocation to emerging markets by allocating to Islamic equities.

Many empirical findings reject the fashioned decoupling hypothesis. According to El Alaoui et al. (2015), there is a non-homogeneous correlation between Islamic and conventional equity markets for various timescales and periods. Studies by Ajmi et al. (2014) found causal relationships between Islamic and traditional stock markets. There is a stronger causal connection in areas with more remarkable development in Islamic finance. Furthermore, there is empirical evidence that Islamic equities are correlated with interest rate changes and conventional securities, which is unusual since Islamic finance prohibits riba (interest). Several studies have demonstrated that Islamic and conventional markets contagion due to fundamental-based factors (economic integration and trade ties), as Rizvi et al. (2015) suggested. A further empirical study by Hammoudeh et al. (2014) revealed that their chosen Islamic index was highly dependent on conventional market proxies at both the upper and lower tails. Islamic equity indices, they argued, are not significantly different from traditional indices because Shariah compliance rules are not restrictive enough. Further, the study found that international factors such as oil prices, the VIX stock market index, U.S. Treasury bond rates, and the EMBI government bond index affect Islamic equities. There was a similar conclusion reached by Naifar (2015).

As a further contribution to the related literature, Yulmaz et al. (2015) argued that Islamic equity prices have been highly integrated over the past decade as global financialization has increased. It is historically significant for Islamic equity prices to be determined by firm fundamentals and natural economic factors. In addition to being vulnerable to global shocks, securities based on Islamic principles are also often susceptible to financial contagion. As a result of the shorter holding period of Islamic equity investments, Najeeb et al. (2015) argued that these investments have limited opportunities for portfolio diversification in Malaysia. It is unlikely to be advantageous to diversify your portfolio with high correlations over a long-term horizon.

Sukuk, another Shariah-compliant asset category, is being studied concerning Islamic equities. Like conventional stocks and bonds, Islamic equities and Sukuks appear to be related (Aloui, Hammoudeh, & Hamida, 2015a). Nowadays, most Sukuk is structured to comply with market rules and norms of securitization in the same manner as conventional bonds. The performance of Islamic equity or the rise in uncertainty causes risk-averse investors to transfer funds to Sukuk when Islamic equity returns falter. This relationship between Islamic stocks and Sukuks is more

easily analyzed using nonlinear models. It was concluded that the long-term and short-term risks of Islamic stocks and Sukuk portfolios differed significantly in Aloui, Hammoudeh, and Hamida's (2015b) report. A longer-term perspective has thus been found to be beneficial. Identifying the relationship and connectivity between markets also requires consideration of factors that influence the degree of integration between the markets.

Dewandaru et al. (2014) found that several factors impede foreign investment in Islamic markets in developing countries, including a lack of increased financial openness, a high degree of bank dependence, and a heavy reliance on the banking sector. Consequently, a capital market is underdeveloped, with fewer funding options. While government effectiveness was regarded as the primary concern of developed countries, it was argued that in developing Islamic countries, corruption should be controlled, unnecessary bureaucracies removed, effective transactions enforced, and sound economic policies should be maintained. Bayraktar (2014) found that the country's capacity and effort greatly influenced the development level of stock markets. According to the study, countries with low market capitalizations and low effort levels are likelier to develop their stock markets to capacity. In this case, the economy is less likely to be distorted.

Despite this, Islamic funds may experience excess volatility due to at least three factors. First, as a result, Islamic funds have fewer diversification opportunities than conventional funds due to prohibiting investment in non-compliant sectors (i.e., pork, alcohol, etc.). Secondly, restricting interest rates will reduce financial resources, resulting in additional restrictions and constraints for Islamic funds that may worsen their chances of bankruptcy and collapse. Bayraktar (2014) argues that the country's capacity and effort can measure the level of development of stock markets. According to this study, countries with low market capitalizations and low effort levels are more likely to develop their stock markets to their full potential. As a result, Islamic funds are not guaranteed to be better suited for managing financial risk, managing risks, or controlling volatility than conventional funds are. A recent economic downturn did not wholly exempt Islamic funds (Jawadi et al., 2014).

From 2008 to 2015, Jebran, Chen, and Tauni (2017) examined the integration of Islamic and conventional indexes. The cointegration method of Johansen and Juselius is used to investigate the long-term association between these two factors. The VECM model is used to analyze the short-run association. Dynamics of volatility spillover are examined using GARCH and EGARCH models. Various methods are used to assess the robustness of the results, including Granger causality, Variance

Decomposition, and Impulse Response Function. According to the estimated results, the Islamic and conventional indexes significantly correlate long- and short-term. Furthermore, the study found that Islamic and conventional indexes are associated with asymmetric bidirectional volatility spillovers. As a result of adding both Islamic and traditional indexes to a portfolio, domestic investors have low diversification opportunities.

In a study by Al-Zoubi and Maghyereh (2007), Value-at-Risk (VaR) analysis showed Islamic indices to be significantly less risky. Chiadmi and Ghaiti (2014) confirmed this result using exponential GARCH models. According to them, Islamic stock indices were not affected as much by the recent financial crisis as their conventional counterparts since they were less volatile. Dewandaru et al. (2015c) reported that Dow Jones Islamic indices have beta mispricing. According to the study, Islamic indices had lower betas than their conventional counterparts but had the same actual returns. There are many examples of this in the consumer goods and services sector. According to them, analyst coverage of the stock was lacking, resulting in the underpricing of the stock. The smaller, less leveraged, or smaller free float of Islamic stocks can cause analysts to overlook them. In any case, these differences do not automatically translate into higher equity costs for Shari'ah-compliant firms. Shariah-compliant stocks receive attention from institutional investors that prefer or require Shariah-compliant stocks; being listed on such a stock has advantages. The Shariah-compliant indices did not react to the Lehman Brothers collapse in the same way as conventional indices (Saiti et al. 2015). The low volatility of the Islamic index compared with traditional indices has important implications for investment managers in asset allocation, risk management, and crisis management. Bousalam and Hamzaoui (2016) report that Islamic indices exhibit lower volatility than conventional indices. Their findings reveal that Moroccan index returns are more volatile when there is good news than bad news. Contrary to what is commonly believed and intuited, this finding is empirically supported.

However, the results of Mansor and Bhatti (2011) showed that Islamic portfolios performed somewhat worse than conventional portfolios. The returns and volatility of Shari'ah-compliant stocks were higher than those of non-compliant stocks(Canepa & Ibnrubbian, 2014). The same was true for the stocks they sampled from the Saudi Arabian equity market. Despite the efficiency market model (where expected cash flows determine stock prices), any of its variants can't explain the observed volatility levels. An understanding of behavioral finance is necessary to explain things. A psychological bias and investor sentiment were posited in support of this theory. Risk-averse rational agents cannot drive out more speculatively motivated noise traders so that they can influence prices.

An Islamic risk factor has also been identified by Merdad, Hassan, and Hippler (2015) for Saudi Arabian stocks that detects strong similarities between cross-sectional expected returns. No matter how large the market, how big the size, or how close the book-to-market is. To achieve Shariah-compliant status, firms need to adjust, adjust, or adapt their practices to earn Shariah-compliant status. These changes, adjustments, or adaptations constitute a standard, systematic, and undeniable risk factor and will directly affect their fundamental value and financial contracts. According to Guyot (2011), Islamic indices are more susceptible to certain risk factors, especially geopolitical effects, which helps diversify portfolios. Based on Khan et al.'s (2015) research, Islamic equities are correlated with commodity markets. The highest correlations were recently seen during the turmoil in the global financial system. Islamic equities and commodities have similar returns, reducing their potential for portfolio diversification. Mainly this is during periods of crisis due to the financialization of commodity markets.

Meanwhile, the gold market stands out as a haven due to its distinctive characteristics. Moreover, Wahyudi and Sani (2014) examined how macroeconomic variables related to the Islamic capital market in Indonesia and concluded that the Islamic index could serve as a fiscal policy barometer. As part of their analysis of the tail risk of an Islamic stock index, Bekri and Kim (2015) found that standard distribution assumptions were not appropriate because fat tails were present. They increased tail risk assessment and time series modeling by a substantial amount over the previous model.

The above discussion and mixed findings concerning conventional and Islamic equity funds volatility motivate us to investigate the volatility dynamics among equity funds of Islamic countries such as Saudi Arabia, Malaysia, and Pakistan. A comparison of equity funds in these countries is conducted in this study to determine whether equity funds exhibit greater resilience to volatility.

Data and Methodology

This study evaluates fund level volatility using data from three mutual fund industries: Saudi Arabia, Malaysia, and Pakistan, from January 2010 to June 2022. The sample period is based on the maximum data availability during this period. Due to the significant spillovers caused by the Covid-19 pandemic, the study uses the end of June 2020 as the terminal cut-off date. During the study period, it is essential to note that the global financial crisis occurred, but only a few selected Islamic nations were affected meaningfully. (Mirza et al. 2015; Naqvi et al. 2017; Wang et al. 2021). It instead experienced positive growth and attracted significant portfolio investments thanks to its unique domestic strengths. As a result, the study does not consider events

associated with the global financial crisis separately. The continuously compounded daily returns are calculated using Eq1. Once the data is extracted, the study uses Eq1.

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

The first step in this study assessment is determining whether the data are normal. It is essential to ensure the data are stationaries using unit root tests. After confirming the stationarity of the data, the study applies the ARCH and GARCH models. Using a daily frequency of data on ARCH/GARCH methods, price data volatility can be standardized (Busse, 1999; Salisu & Gupta, 2021). According to the study, mean and variance equations can be defined as :

$$r_t = \psi_{t-1} \sim \mathrm{N}\left(\mathrm{K}\, X_{t-1}, h_t\right) \quad (2)$$

$$E_t\, \varepsilon_t^2 = h_t = \propto_o + \sum_{i=1}^{q} \alpha_i\, \varepsilon_t^2 \quad (3)$$

A conditional mean of returns is represented by equation (2), which utilizes the data set from the previous period (t-1) to calculate, at period (t), the conditional mean of returns. There is also a conditional variance in Eq (3), which is dependent on the information that was provided in the previous period (t-1) concerning the unanticipated shock to return at the time (t-1). A zero coefficient in Eq(3) will result in a constant conditional variance of errors. The conditional variance will not be constant in our analysis since we want the return to vary over time. Therefore, there must be at least one coefficient greater than zero for the regression to be valid. Through the application of constraint $\sum_{i=1}^{q} \alpha_i < 1$ to the ARCH process, we are ensuring that the covariance of the process will be stationary in covariance. It is sufficient to have all ARCH parameters be positive, though not all ARCH parameters need to be positive for the conditional variance to be positive.

Since shocks to returns are assumed to persist, lagged squared residuals of ARCH models need to be considered to assess their impact. As Bollerslev (1986) suggested, the GARCH model can be used to model persistence in this case. GARCH processes (p,q) result in a conditional variance of returns that is influenced by both a lagged forecast error value as well as a lagged variance value itself that is also influenced by another variable (Eq (4)). Consequently, we can use the GARCH model to estimate the conditional variance of returns by using Eq(4) to calculate the conditional variance of returns using the GARCH model;

$$h_t = \propto_0 + \sum_{i=1}^{q} \propto_i\, \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j\, h_{t-j} \quad (4)$$

Here $\propto_0 > 0$ and $\propto_i > 0$, i = 1,2,3…….q

$\beta_j > 0$, j = 1,2,3,…….p

There are several advantages to GARCH over ARCH. ARCH is limited to only two parameters, while GARCH can account for an unlimited number of past squared errors. The primary limitation of this GARCH model is that as it is symmetric by default, it can respond equally well to good and bad shocks. An asymmetric GARCH model would be more suitable to simulate these effects since the study will separately demonstrate the impact of good and bad shocks (news). Nelson (1991) proposed the EGARCH model, and Glosten et al. (1993) proposed the GJR model as an asymmetric GARCH model. Using the EGARCH model to capture both shocks' positive and negative effects is also possible. If GARCH parameters were to be expressed using a log (as opposed to a positive log), in this way, their parameters would no longer be artificially restricted to the negative. Using the EGARCH model as an example, the variance equation would be the following:

$$lnh_t = \propto_0 + \sum_{i=1}^{p} \propto_i \left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sqrt{h_{t-k}}} + \sum_{j=1}^{q} \beta_i \, lnh_{t-j} \quad (5)$$

An extra independent variable is included to correct for possible asymmetries between the leverage effects and the regression coefficients in the GJR-GARCH model, an extension of the original GARCH model. The third variable results from an interaction between the lagged error squared and the sign dummy of the lagged error, which resides at 1 for negative values and 0 for positive values for the lagged error. Thus, it will consider that a negative shock could have a negative impact on the economy. As a result of this, we have the following variance equation;

$$h_t = \propto_0 + \propto_1 \varepsilon_{t-1}^2 + Y \, \varepsilon_{t-1}^2 \, I_{t-1} + \beta_1 \, h_{t-1} \quad (6)$$

Y can become positive and significant if the shock results in negative returns. As a result, returns are likely to be more volatile after the shock or conditional variance, depending on the shock frequency.

The next step in analyzing the data would be to run the test to detect either small or large biases in the data. It would be helpful if we could establish through the results of these tests whether or not the volatility of the price of the good news would be equal to the volatility of the cost of the bad news in terms of the increase in volatility. The residuals from the GARCH model are the main focus of these tests, which analyze the residuals from the model. Suppose φ_1 is reported as significant in Eq(7). In that case, a sign bias is involved, meaning that the volatility of returns is affected differently in the event of good or bad news.

$$\hat{\varepsilon}_t^2 = \varphi_0 + \varphi_1 S_{t-1}^{-} + \upsilon_t \quad (7)$$

If $\varepsilon_{t-1} < 0$ then S_{t-1}^{-} will be equal to 1 and 0 otherwise.

In the above equation (7), υ_t represents an error term. In Eq(8), S_{t-1}^{-} will be treated as a slope dummy variable to account for size bias. Using Eq(9), the study can further verify our hypothesis by testing for both sign and size bias.

$$\hat{\varepsilon}_t^2 = \varphi_0 + \varphi_1 S_{t-1}^{-} \varepsilon_{t-1} + \upsilon_t \quad (8)$$

$$\hat{\varepsilon}_t^2 = \varphi_0 + \varphi_1 S_{t-1}^{-} + \varphi_2 S_{t-1}^{-} \varepsilon_{t-1} + \upsilon_t \quad (9)$$

The above Eq.(9) suggests that the impact of bad news on returns will differ depending on whether the $\varphi_1$is significant. The presence of size bias will imply a substantial value of φ_2. Thus, a significant impact will be exerted on the volatility of stock returns once the news's size and magnitude are announced. The study will compute TR^2 statistics derived from joint tests based on the χ^2 $(Chi - Square)$ following the numerical estimates. The null hypothesis is that the model under test is symmetrical. There are n-2 degrees of freedom in the model. The volatile return behavior will be captured by sketching news impact curves. Based on all information kept constant, these curves depict the relationship between ε_{t-1} and h_t. A graphical representation of market volatility can be obtained by comparing these curves with market movements that are strong and weak, and we can also predict the future implications of past shocks on volatility (h_t) based on past observations (ε_{t-1}). A quadratic function will plot the GARCH model, with its center located at the point where ε_{t-1}= 0. E-GARCH (1,2), GJR-GARCH (1,1) & S-GARCH (1,0) are defined as follows:

$$h_t = a + \alpha_1 \varepsilon_{t-1}^2 \quad (10)$$

Here $a = \alpha_0 + \beta_1 \bar{\sigma}^2$ and $\bar{\sigma}^2 = \frac{\alpha_0}{1 - \alpha_1 - \beta_1}$

$$h_t = a + \alpha_1 \gamma_1 I_{t-1} \varepsilon_{t-1}^2 \quad (11)$$

Here $a = \alpha_0 + \beta_1 \bar{\sigma}^2$ and $\bar{\sigma}^2 = \frac{\alpha_0}{1 - \alpha_1 - \beta_1 - \frac{\gamma_1}{2}}$

$$h_t = a e^{\left\{\frac{\alpha_1(|\varepsilon_{t-1}| + \gamma_1 \varepsilon_{t-1})}{\bar{\sigma}}\right\}} \quad (12)$$

Here a = $\bar{\sigma}^2 \beta_1 e^{\alpha_0}$ and $\bar{\sigma}^2 = e^{\frac{\alpha_0 + \alpha_1 \sqrt{\frac{2}{\pi}}}{1 - \beta_1}}$

Analysis of the results and discussion

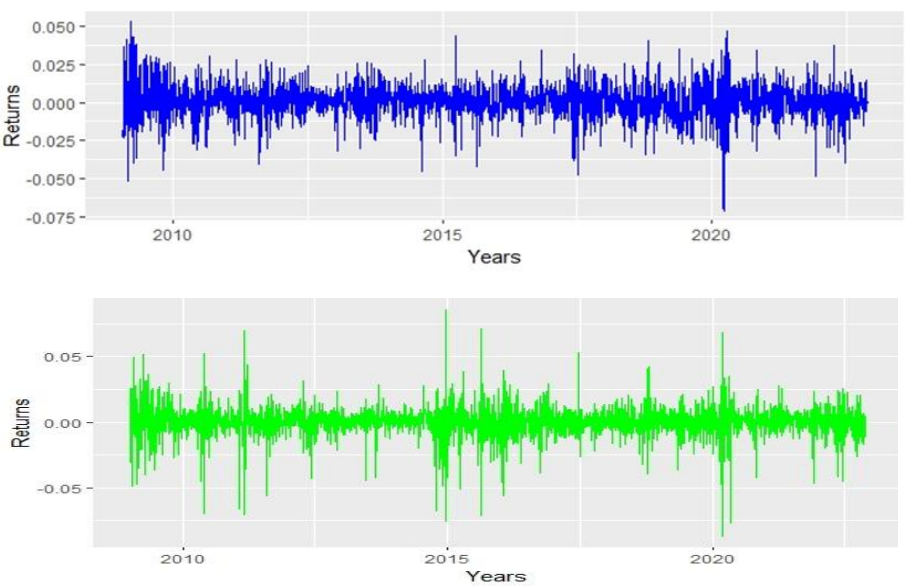
Stationarity and partial correlations

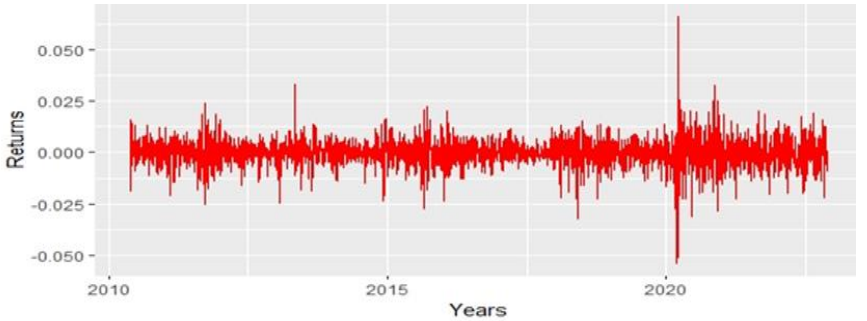
An Augmented Dickey-Fuller unit root test (ADF) is presented in Table 1. Based on critical values, the study rejected a unit root phenomenon at a 1% significance level. Therefore, the study concludes that the data do not contain any unit roots, so the survey can continue with further analysis.

Table 1. Dickey-Fuller test for unit root

	Pakistan		Saudi Arabia		Malaysia	
	t-Stat	Prob	t-Stat	Prob	t-Stat	Prob
Augmented Dickey-Fuller tests	-53.68	0.000	-56.70	0.000	-50.40	0.000
Critical Values						
1%	-2.33					
5%	-1.65					
10%	-1.28					

Fig.1 Volatility Clustering of Saudi, Malaysian, and Pakistani Funds returns



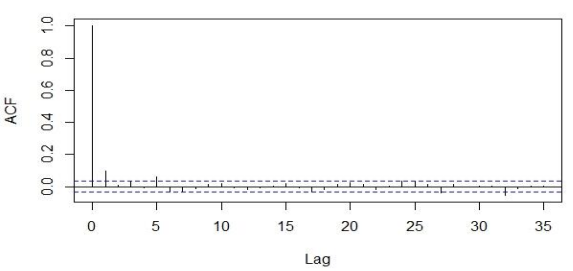


The study also investigates the daily returns' correlogram to determine whether there is a partial correlation or autocorrelation. There is no auto or partial correlation, according to Table.2, showing no auto or partial correlation.

Table.2 Correlogram

Lag	AC	PAC	Q	Prob
Malaysia				
1	-0.22	-0.31	74.5	0.000
2	0.01	-0.09	75.1	0.000
Pakistan				
1	-0.21	-0.28	63.9	0.000
2	0.01	-0.12	63.9	0.000
Saudi Arabia				
1	-0.26	-0.32	100.9	0.000
2	0.03	-0.03	102.6	0.000

Fig 2(a). Saudi equity fund ACF and PACF



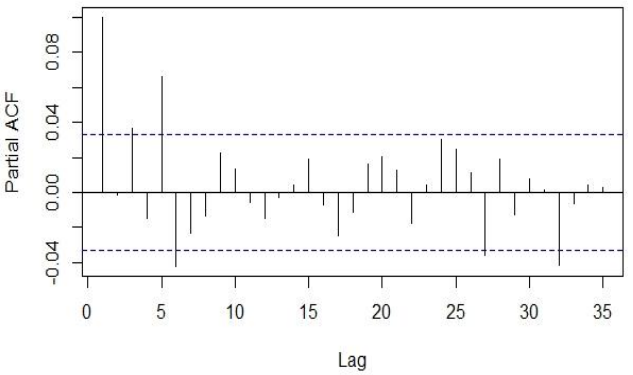


Fig 2(b). Saudi Fund ACF and PACF

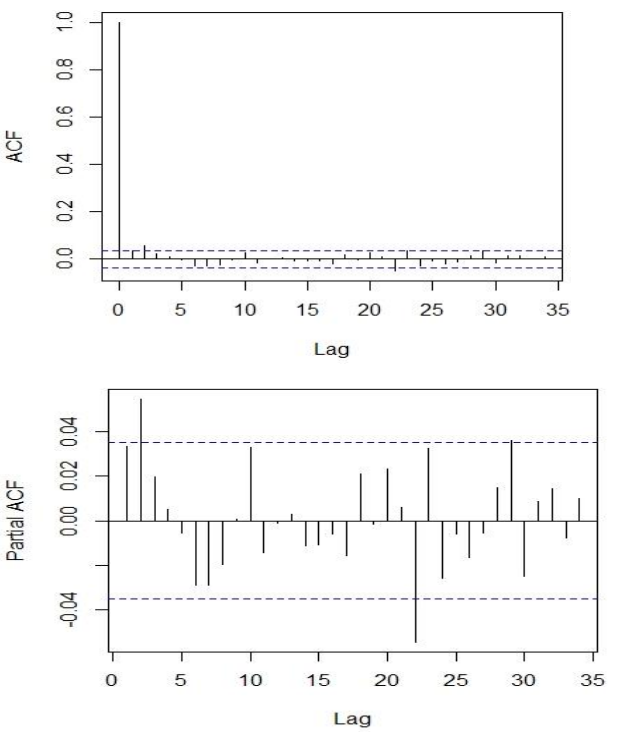
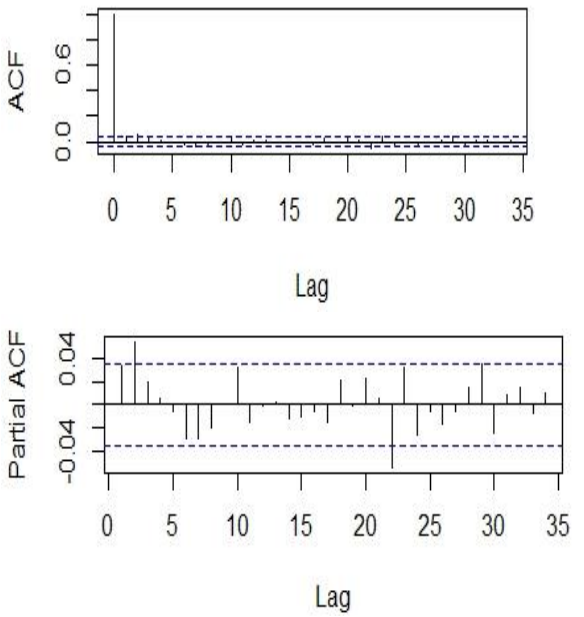


Fig 2(c). Pakistani equity fund ACF and PACF



Estimates of Volatility for Saudi equity funds

Three regressions are used to estimate the GARCH. As shown in Tables 3, 4, and 5, the first, second, and third columns provide the GARCH, E-GARCH, and GJR-GARCH for Saudi, Malaysian, and Pakistani equities funds, respectively. The study considers three models, each with a different time lag. AIC and SIC are used to determine whether a time lag is optimal based on Akaike's Information Criteria (AIC). The AIC and SIC of the models are selected based on their lowest values. The results of our estimations indicate that it is most optimal to have a 1-time lag. GRACH models have all been estimated to have significant coefficients at the 1% level for all three models.

Before running the GARCH test, we need to check the ARCH effect in the data. So, when the study performs the ARCH LM-test under the null hypothesis of no ARCH effect, the study found the ARCH effect. The study found that daily returns of all three countries' funds have a statistically significant ARCH effect. After testing the primary conditions of the GARCH family, the study now applies the GARCH models. Before using the GARCH model, the study should know which GARCH order model is suitable. Alpha represents the ARCH order, and beta means the GARCH order. After performing the trace order methods, the study found that our arch coefficient equals 0.050 and GARCH coefficient beta equals 0.050 at order one. So, we found that our p and q are also one. So, we found our GARCH order is GARCG (1,1).

Table.3 Comparing conditional variance estimates S-GARCH, E-GARCH, and GJR-GARCH.

Saudi Arabia			
Variables	S-GARCH	E-GARCH	GJR-GARCH
Mean Equations			
C	0.001***	0.001***	0.000***
α	0.362***	0.332***	0.395***
Variance Equations			
α_0	0.000***	- 0.567***	0.000***
α_1	0.164***	- 0.166***	0.002***
γ		0.204***	0.239***
β_1	0.791***	0.935***	0.826***
AIC	-6.050	-6.111	-6.100
SIC	-6.050	-6.111	-6.090

****, **, * respectively indicates rejection of the null at 1%, 5% and 10 % significance levels.*

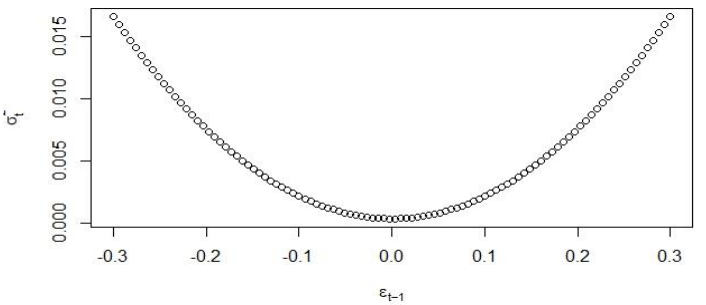
According to the results of the S-GARCH regression, intraday spillover is lagged by volatility. A positive shock is as effective as a negative shock. Despite this, these results cannot substantiate the claim that asymmetry is present based on differences between positive and negative surprises in the volatility response. For this reason, the study proceeds with two regressions, the E-GARCH and GJR-GARCH regressions. GJR-GARCH was used to identify the persistence of volatility, which is evident from the significant level of β_1 obtained from the results of the GJR-GARCH model. These results align with Kin et al. (2021), who investigated the volatility forecasting of Malaysian mutual funds. Additionally, the GAMA term is significant and positive, implying that during the next period, there would be a more substantial impact on the volatility of the negative returns than on the positive returns induced by the negative returns. E-GARCH Model also confirms persistence and asymmetry in volatility, with all parameters, including asymmetry, significant, which is aling with Foran and O'Sullivan (2017), who investigated the volatility of U.K. mutual funds and found volatility skills of fund managers persist and have a strong relationship performance.

Saudi Funds News Impact Curves (NIC)

Graphing the relationship between shocks and volatility in subsequent periods is the next step of the analysis. The News Impact Curve (NIC) was developed following the work of Rizvi & Naqvi (2008). Fig (3a) shows the results for the S-GARCH for the NIC model. This presentation confirms our previous research (Umar et al., 2021) that the shock in the current period positively affects volatility in the subsequent

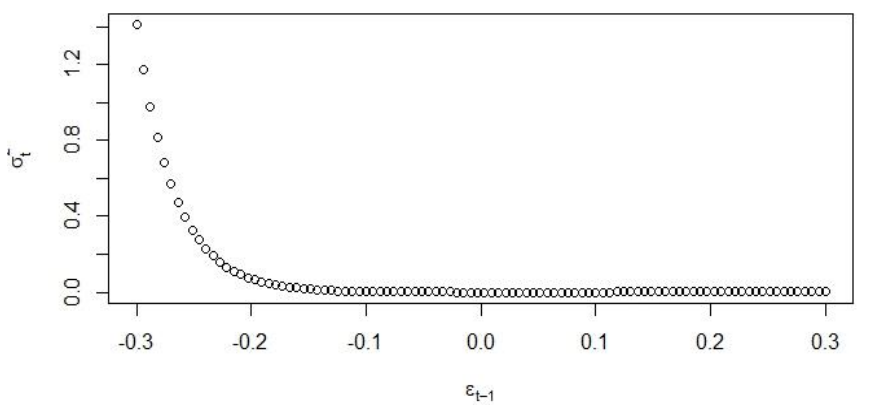
period. Volatility does not show the asymmetries in the simple GARCH model since positive and negative shocks produce identical volatility responses.

Fig 3a. NIC for S-GARCH



NIC for E-GARCH (Fig 3b) shows that the volatility of returns is significantly higher for a negative shock than for a positive shock, which confirms our conclusion that adverse shocks impact the volatility of returns more significantly than positive shocks. This result also aligns with Umar et al. (2021), who find the shock impact on market volatility by investigating emerging market volatility structures.

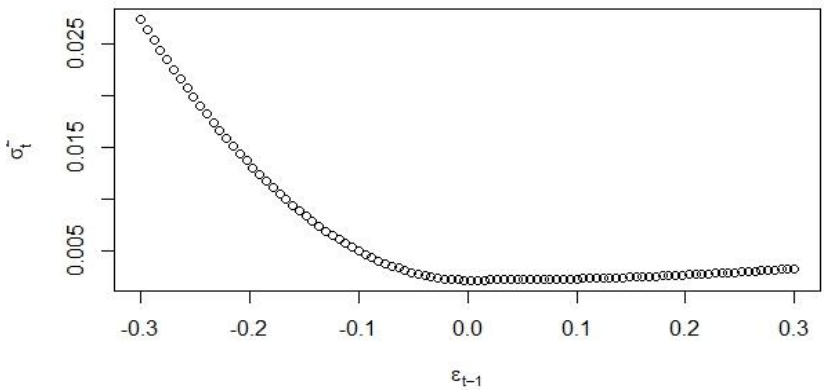
Fig 3b. NIC for E-GARCH



A third NIC was created for the GJRGARCH model (fig. 3c). As you can see from the figure below, our results are strongly supported by this figure. As a result, it shows that positive shocks in the current period have a less significant impact on the volatility of the following day than adverse shocks do in the current period. Positive shocks have almost no effect on volatility, as seen from the flat slope of the news

impact curve in the positive domain, demonstrating virtually no positive shock impact on volatility, contrary to the results of Umar et al. (2021).

Fig 3c. NIC for GJR-GARCH



Estimates of Volatility for Malaysian equity funds

Table.4 Comparing conditional variance estimates S-GARCH, E-GARCH, and GJR-GARCH.

	Malaysia		
Variables	S-GARCH	E-GARCH	GJR-GARCH
Mean Equations			
C	-0.0001	-0.0003**	-0.0002**
α	0.478***	0.462***	0.462***
Variance Equations			
α_0	0.000	-0.144***	0.000
α_1	0.116***	-0.088***	0.029***
γ		0.164***	0.131***
β_1	0.868***	0.985***	0.901***
AIC	-7.440	-7.464	-7.459
SIC	-7.440	-7.464	-7.459
BIC	-7.429	-7.450	-7.445

****, **, * respectively indicates rejection of the null at 1%, 5% and 10 % significance levels.*

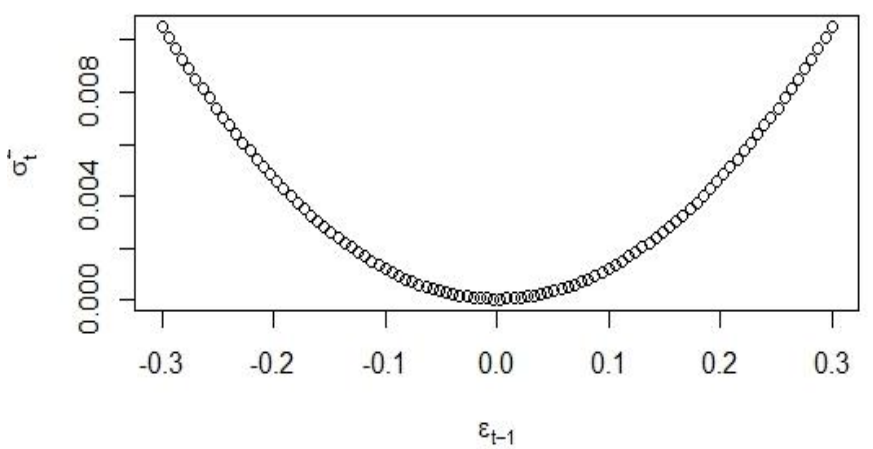
The results are similar to the Saudi equity fund market. According to the results of the S-GARCH regression, intraday spillover is lagged by volatility. A positive shock is as effective as a negative shock. Despite this, these results cannot substantiate the

claim that asymmetry is present based on differences between positive and negative shocks in the volatility response. For this reason, the study proceeds with two regressions, the E-GARCH and GJR-GARCH regressions. GJR-GARCH was used to identify the persistence of volatility, which is evident from the significant level of β_1 obtained from the results of the GJR-GARCH model as aligned with Kin et al. (2021). Additionally, the GAMA term is significant and positive, implying that during the next period, there would be a more substantial impact on the volatility of the negative returns than on the positive returns induced by the negative returns. E-GARCH Model also confirms persistence and asymmetry in volatility, with all parameters, including asymmetry, significant, similar to Foran and O'Sullivan (2017).

Malaysian Equity Funds News Impact Curves (NIC)

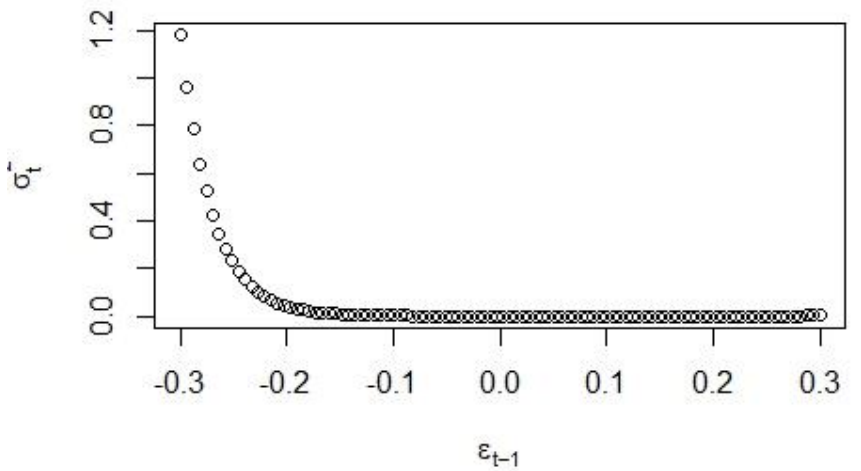
Fig (4a) shows the results for the S-GARCH for the NIC model. This presentation confirms our previous research that the shock in the current period positively affects volatility in the subsequent period. Volatility does not show the asymmetries in the S-GARCH model since positive and negative shocks produce identical volatility responses similar to Umar et al. (2021).

Fig 4a. NIC for S-GARCH



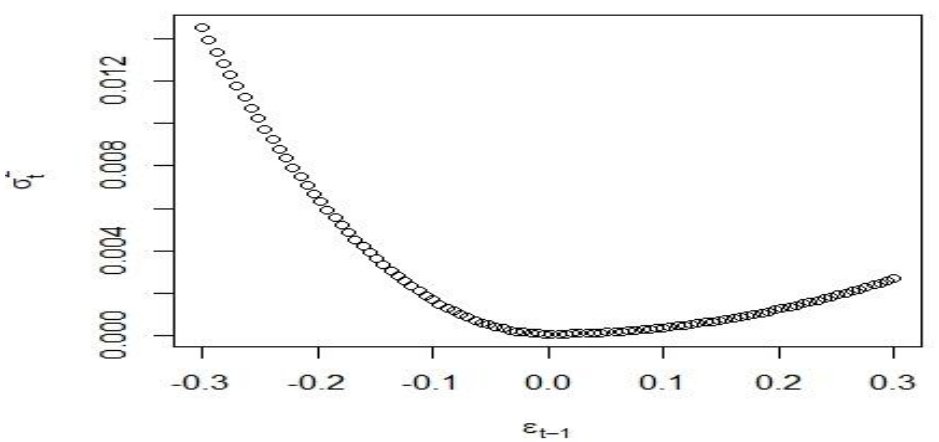
News Impact Curve (NIC) for E-GARCH (Fig 4b) shows that the volatility of returns is significantly higher for a negative shock than for a positive shock, which confirms our conclusion that negative shocks impact the volatility of returns more significantly than positive shocks which are aligned with Umar et al. (2021).

Fig 4b. NIC for E-GARCH



A third NIC is for the GJRGARCH model shown in Fig. 4c. As the figure below indicates, this figure strongly supports our results. As a result, it shows that positive shocks in the current period have a less significant impact on the volatility of the following day than adverse shocks do in the current period. Positive shocks have almost no effect on volatility; news impact curves are flat when measured positively, as can be seen from their flat slope, demonstrating virtually no positive shock impact on volatility, similar to Umar et al. (2021).

Fig 4c. NIC for GJR-GARCH



Estimates of Volatility for Pakistani equity funds

Table.5 Comparing conditional variance estimates S-GARCH, E-GARCH, and GJR-GARCH.

	Pakistan		
Variables	S-GARCH	EGARCH	GJRGARCH
Mean Equations			
C	-0.0001	-0.001**	-0.000**
α	0.478**	.462***	0.462***
Variance Equations			
α_0	0.000	-0.144***	0.000
α_1	0.116***	-0.088**	0.029***
γ		0.164***	0.131***
β_1	0.868***	0.985***	0.901***
AIC	-7.4403	-7.4636	-7.4588
SIC	-7.4403	-7.4636	-7.4588
BIC	-7.4286	-7.4587	-7.4451

****, **, * respectively indicates rejection of the null at 1%, 5% and 10 % significance levels.*

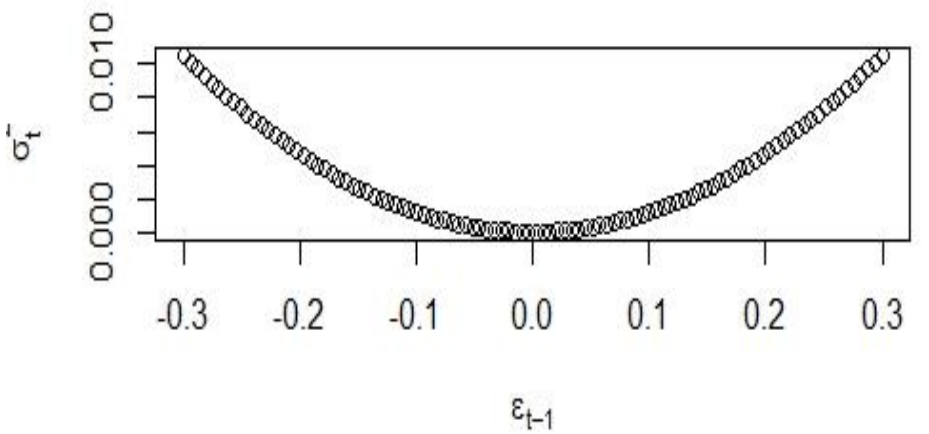
Table. 5's results are similar to the Saudi and Malaysian equity fund markets. According to the results of the S-GARCH regression, intraday spillover is lagged by volatility. A positive shock is as effective as a negative shock. Despite this, these results cannot substantiate the claim that asymmetry is present based on differences between positive and negative shocks in the volatility response. For this reason, the study proceeds with two regressions, the E-GARCH and GJR-GARCH regressions. GJR-GARCH was used to identify the persistence of volatility, which is evident from the significant level of β_1 obtained from the results of the GJR-GARCH model like Kin et al. (2021). Additionally, the GAMA is statistically positive and significant, which shows that during the next period, there would be a more substantial impact on the volatility of the negative returns than on the positive returns induced by the negative returns. E-GARCH Model also confirms persistence and asymmetry in volatility, with all parameters, including asymmetry, significant as Foran and O'Sullivan (2017).

Pakistani Equity Funds News Impact Curves (NIC)

Fig (5a) shows the results for the S-GARCH for the NIC model. This presentation confirms our previous research that the shock in the current period positively affects volatility in the subsequent period. Volatility does not show the asymmetries in the

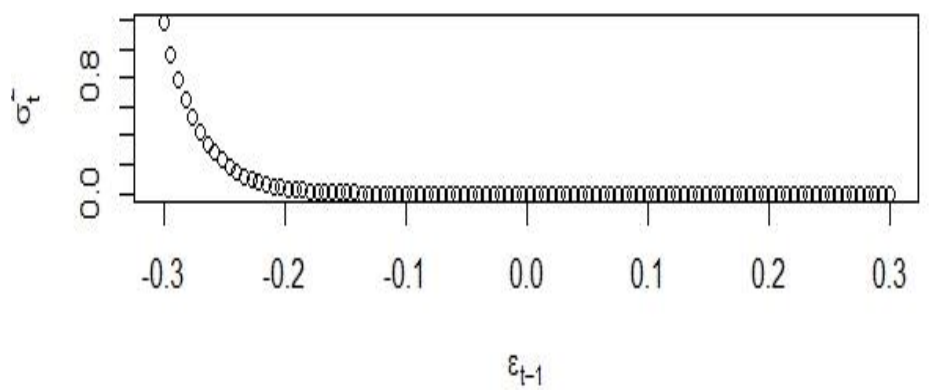
S-GARCH model since positive and negative shocks produce identical volatility responses. The results align with Umar et al. (2021).

Fig 5a. NIC for S-GARCH



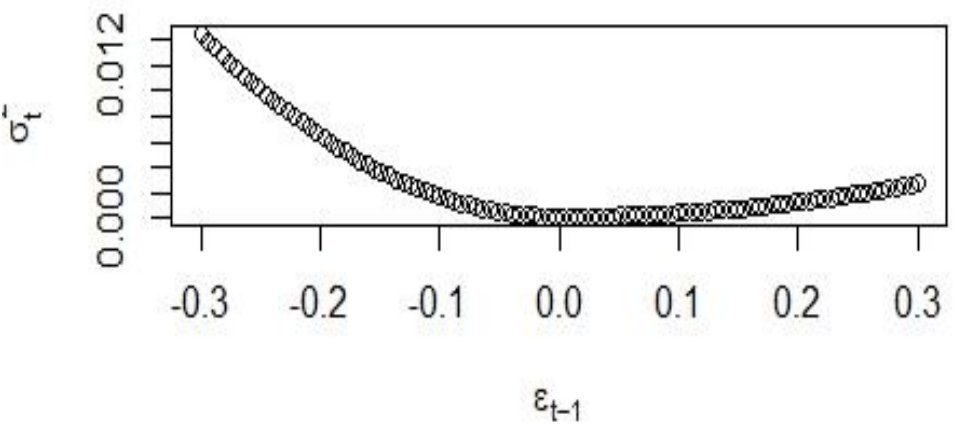
News Impact Curve (NIC) for E-GARCH (Fig 5b) shows that the volatility of returns is significantly higher for a negative shock than for a positive shock, confirming our conclusion that negative shocks impact the returns more significantly than positive shocks like Umar et al. (2021).

Fig 5b. NIC for E-GARCH



A NIC is for the GJRGARCH model shown in Fig.5c. As the figure below illustrates, this figure strongly supports our results. As a result, it shows that positive shocks in the current period have a less significant impact on the volatility of the following day than adverse shocks do in the current period. Positive shocks have almost no effect on volatility; news impact curves are flat when measured positively, as can be seen from their flat slope, demonstrating virtually no positive shock impact on volatility, contrary to Umar et al. (2021) results.

Fig 5c. NIC for GJR-GARCH



Conclusion

A difference in equity return volatility characterizes emerging markets compared to developed markets. This study analyzes the volatility structure for the Saudi, Malaysian, and Pakistani equity funds and looks at the underlying drivers. This study primarily aims to determine whether there is any persistence or asymmetry in the volatility based on the distribution of returns. Based on our results, we can conclude that the volatility in daily returns is persistent and has a pronounced impact on prices. These results are in line with the results of Busse (1999). Due to the short period for daily returns, some managers(investors) are susceptible to quick reactions. However, some managers take some time before they can understand this and integrate it into their prices, which results in a much greater level of volatility. It is also evident from the volatility data that there is an asymmetry. These results are similar to the study of Umar et al. (2021).

These asymmetries are also very much influenced by the type of news produced. A Volatility level may be affected the following day by negative news or shocks

triggered by recent volatility cycles, especially if the negative news or shock continues throughout the day. An investor reacts abruptly to avoid panic and loses confidence when there is a risk of a negative return on their portfolio, which causes them to adjust the investment portfolio holdings unexpectedly to prevent panic. When a positive shock occurs, the level of volatility that ensues is not likely to be much greater than the volatility of the returns the next day. Market managers (investors) are more aggressive in taking advantage of opportunities now available than when the outlook is bullish, yet the market is more stable. The study found similar results in all three selected Islamic countries. Further analysis can enhance the generalization of the results by taking more Islamic countries of emerging markets and their comparison with the conventional emerging market.

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