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VOLATILITY FORECASTING IN FINANCIAL MARKET "AN APPLICATION OF GARCH MODEL".

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ABSTRACT: This thorough review brings together recent studies that explore various aspects of financial markets worldwide and specific topics. It examines how different factors affect financial markets, such as how closely connected economies impact stock market trends in Asia, challenges banks face when sharing information after major financial crises, the performance of safe investments in India, and how having too many investments in one area can affect market activity. The review also studies how well companies that follow and manage risk. It also examines how vaccinations affect market stability during the COVID-19 pandemic and how problems in the NASDAQ stock market affect other countries.

The review highlights how important these findings are for understanding how financial markets work and the problems with regulation. It shows how people can use these results to make better choices in the financial markets and gives ideas for future research.

1.INTRODUCTION:

In this comprehensive review, a multitude of studies investigating different facets of financial markets are synthesized, spanning diverse regions and topics. Song et al. (2021) delve into the intricate relationship between economic integration and stock market co-movements in India and major Asian markets, highlighting the consequential positive association between economic integration and stock market interdependence. Conversely, Bhimavarapu et al. (2023) tackle the post-2008 global financial crisis disclosure challenges faced by banks, underscoring the vital need for transparency and accountability in bank disclosures to uphold regulatory standards. Janani Sri et al. (2022) explore the concept of safe-haven investments, particularly focusing on quality stocks in the Indian context, uncovering their potential for impressive returns amidst a relatively safe investment environment. Meanwhile, Pandey and Sharma (2023) probe the complexities surrounding index concentration and its implications for index performance across various markets, shedding light on the nuanced relationship between concentration risk and index returns. Cheong (2021) ventures into uncharted territory by examining the effects of shariah-compliance on non-financial firm operations globally, revealing lower risk and greater resilience among shariah-compliant firms, thus adding a novel dimension to the discourse on corporate governance and capital structure. Furthermore, To et al. (2023) offer valuable insights into the economic significance of vaccination rates on worldwide financial exchange unpredictability during the Coronavirus pandemic, emphasizing the role of mass immunization efforts in stabilizing financial markets. Vo et al. (2022) provide a timely reassessment of the impact of the COVID-19 pandemic on market volatility in Asia-Pacific countries, highlighting the evolving nature of pandemic-related volatility and its implications for market stability. Additionally, the studies by Wang et al. (2022) and Das and Debnath (2022) delve into the dynamics of market volatility, particularly focusing on the volatility spillover effects from indices such as NASDAQ to regional markets, shedding light on the interconnectedness and transmission mechanisms of volatility in the global financial landscape. Together, these studies enrich our understanding of financial market dynamics, regulatory challenges, and the profound impact of external factors such as economic integration, public health crises, and volatility spillovers from prominent indices like NASDAQ, thereby informing decision-making processes and guiding future research endeavours.

1.1 Conceptual framework

The analysis delved into various mathematical models aimed at comprehending the dynamics of price fluctuations within the NASDAQ stock market. Initially, a simplistic model was employed, providing a foundational understanding of how prices evolve over time. Subsequently, more intricate models were introduced, each incorporating additional factors and complexities to enhance predictive accuracy. These models serve a vital purpose in assisting investors and regulatory bodies in assessing market risk. By offering insights into the underlying mechanisms driving price movements, they empower stakeholders to go with informed choices and carry out powerful techniques to mitigate risk and maintain market stability. However, it's crucial to recognize the limitations inherent in these models. While they provide valuable insights, they cannot capture every nuance and unforeseen event within the market. Therefore, they should be used in conjunction with other analytical tools and qualitative assessments to form a comprehensive understanding of market behavior. In essence, these models represent a valuable tool set for market participants, offering a deeper understanding of potential market trends and facilitating more prudent decision-making processes.

1.2 Review of literature:

In another study, bhimavarapu et al. (2023) address the issue of disclosures in banks, particularly concerning ownership concentration (oc) and its impact on transparency and disclosures (t&d) post the 2008 global financial crisis. The authors highlight the challenges faced by banks in complying with the iii pillar of basel-ii, introduced in 1999, which pertains to disclosures. Employing a panel data approach, the study constructs a t&d index covering contemporary issues related to bank disclosures. Findings suggest that apart from retail investors, other classes of ownership concentration do not significantly influence disclosures in banks, despite substantial financial and non-financial interests. The study underscores the need for regulatory frameworks that hold promoters and institutional investors accountable for ensuring transparency in bank disclosures. Notably, bhimavarapu et al. (2023) contribute uniquely by constructing a t&d index specific to banks and examining its association with ownership classes, filling a gap in existing literature. In another study, Pandey and Sharma (2023) investigate the effect of index concentration on component security and index variances to explore the possibility of concentration risk and its impact on index performance across different markets. Focusing on the bricks' (brick plus USA) markets, the authors analyse focus gauges and decide record instability and returns utilizing the mean-difference model. Through a basic reproduction, they look at the responsiveness of connections and track down that the effect of file focus on record fluctuation, part security covariance, and file execution differs across business sectors, impacted by financial backer predispositions and the consideration of global organizations in the record. Moreover, they show that extreme development of a couple of organizations doesn't be guaranteed to increment risk in the file, yet may give data advantages to financial backers. The review presumes that file focus is a conventional cycle in serious economic situations, with no clear record fixation cost for financial backers proved by the lower Sharpe proportion of the equivalent weighted record. Regardless of the predominance of Islamic cash, the effects of shariah-consistence on non-money related firm Undertakings have never been inspected. Shariah-consistence essentials presents exceptional conditions to see how firms perform under bound conditions. This paper hopes to examine the effects of shariah-consistence on the bet and adaptability of non-money related firms. Using a strong board structure Gmm and an enormous gathering of firm-express characteristics, and an overall illustration of 2,160 firms across six geographic Districts, the results recommend that shariah-reliable firms have lower firm bet as assessed by complete and specific bet, and more critical firm strength as assessed by the percent deviation from the Most outrageous potential gains of arrangements, cost of items sold, working expenses, and proposition cost. These effects are More critical not long after the u.s. subprime crisis. Results in like manner show socio-social Norms to have a coordinating effect. Further testing shows firms deal with strong repercussions for losing their Shariah-consistence status. This paper rushes to focus on the effects of shariah-consistence on non-Money related firm methodology on an overall scale. This paper similarly adds to the capital development and corporate organization composing as it gives confirmation that suggest resource limitations may be Valuable for a firm. The discoveries of this paper additionally offer critical benefit to firms hoping to Profit by the 1.8 billion-in number Muslim market with additional knowledge on the complexities of shariah-Consistence (cheong, 2021). The information, except if handled, may not uncover its story. It is the occupation of an information investigator to handle the crude Information for some significant reason with the goal that it tends to be utilized for the independent direction. Each dataset has Its own story to tell. Notwithstanding, it is the science and craftsmanship (both simultaneously) of the information investigation to Utilize the dataset actually to help every one of the partners of the corporate world. The Utilization of information examination in finance useful region is similarly significant. Monetary information investigation (FDA) may contrast from the showcasing based information examination in light of strength of auxiliary information and time series information. However, the basic tenets of the data analysis prevail even for FDA as Well (Gautam et al., 2022). During the Coronavirus pandemic, the insight about clinical preliminaries for antibodies and mass inoculations have Brought recharged idealism for balancing out the economy and monetary business sectors. Be that as it may, the psychological Pressure of financial backers or uncertainty about the viability of government arrangements to adapt to monetary Interruptions has caused securities exchange unpredictability. We examine the meaning of the immunization rate in lightening the worldwide securities exchange unpredictability which is assessed by the gjr-garch model. We Find that a higher inoculation beginning rate insistently influences overall monetary trades, particularly in created nations and regions with higher rates than their normal. Our discoveries stay dependable in any event, while utilizing different projected unpredictability models and different evaluations of the vitally autonomous Factors. Mass vaccination additionally infers that states won't need to go to outrageous lengths to deal with the pandemic, which reduces financial backer stresses over consistence and the drawn-out Impacts of Coronavirus. Our research indicates that global stock markets are providing insight into the Economic value of the development of covid-19 vaccines, even before public vaccinations start (toEt al., 2023). Sheikh et al. (2023) investigate the effects of changes in oil prices, gold prices, and volatility indices (vix, ovx, gvz) on index returns of conventional and shariah indices in the USA, Europe, and Asia, both before and during the covid-19 pandemic. The study utilizes Ols and quantile regression methods to inspect the effect of logical elements on record brings dispersion back. Discoveries uncover that instability files essentially affect record returns, especially during the Coronavirus time frame, indicating that high volatility, driven by factors like oil and gold prices, affects financial markets globally. The study underscores the importance of timely information dissemination in reducing market volatility, especially considering governments' limited control over commodity prices. Bandhu Majumder (2022) examines the hedging and safe haven properties of gold, cryptocurrency, and commodities against the Indian equity market. The study estimates these properties across various securities exchange lists and levels of market instability utilizing a multivariate garch system. Discoveries recommend that gold, cryptographic money, and most products display huge abilities to support, with just flammable gas, raw petroleum, and aluminum showing place of refuge properties. Notwithstanding, neither gold nor digital money qualifies as a place of refuge resource. The financialization of the Indian items market improves financial backers' supporting and place of refuge capacities, with the most un-negative wall extent and most critical positive supporting ampleness saw for stock-crude oil and stock-combustible gas portfolios. The study concludes that these observations remain consistent even during the covid-19 crisis. Bhowmik and wang (2020) contribute to the field of business research methodology by conducting a systematic literature review focusing on the application of summed up autoregressive restrictive heteroskedastic (garch) models in analysing securities exchange returns and volatility. The review utilizes a systematic database search and snowballing technique to ensure comprehensiveness. By examining 50 papers published between 2008 and 2019, the study identifies significant changes in research trends over the past decade, particularly emphasizing the improvement of financial exchanges.The secondary purpose of the review is to conduct a content analysis of the literature, highlighting effective garch models recommended for analysing market returns and volatilities. Sabiruzzaman et al. (2010) investigate the pattern of volatility in the daily trading volume index of the Hong Kong stock exchange. The exact proof recommends that the tgarch detail beats the garch determination, particularly in capturing asymmetric information and the leverage effect of volatile stock markets. Su and Fleisher (1999) study the cross-section pattern of under-pricing of Chinese initial public offerings (ipos) using data from 1987 to 1995. They find that under-pricing can be made sense of by an isolating harmony under deviated data, where firms signal their value to investors. The study also explores alternative explanations for ipo under-pricing, including bribery of bureaucrats and lottery mechanisms for allocation of ipo shares, and examines contrasts in starting returns among an and b shares. Magnus and eric Fosu (2006) examine the effect of imports and exports on the service sector productivity of Ghana from 1970 to 2013 using annual time series data. They use the expanded dickey-all the more full test (adf) and the Kwiatkowski-Phillips-Schmidt-shin (kpss) test to review the effect of outside shocks on imports, items, and organization region proficiency. Standard least squares (ols) technique is utilized to dissect the job of imports and commodities on assistance area efficiency. Results demonstrate that outside shocks to imports, commodities, and administration area efficiency are extremely durable, with a negative huge impact of commodities and a beneficial outcome of imports on help area efficiency in Ghana. The review proposes that policymakers could depend on imports to impact administration area efficiency as opposed to trades, and prescribes further exploration to investigate the impact of imports of labor and products on help area efficiency. Guidi (2008) conducts a study with dual objectives. Firstly, the paper compares various garch family models to display and conjecture the contingent fluctuation of German, Swiss, and uk securities exchange records. The findings indicate evidence of asymmetric effects in all garch family models, with each market having a model that prompts better unpredictability gauges. Furthermore, the review examines the long-run connection between these business sectors utilizing cointegration strategy. The outcomes recommend that the dax30, ftse100, and smi files move together in the long haul, indicating a positive long-run relation. Moreover, the Swiss market appears to be the initial receptor of external shocks, highlighting the interconnectedness of these markets despite not sharing a common currency. Maclaren (2013) focuses on the delineation and characterization of shelterbelts in canterbury, New Zealand, using high spatial resolution satellite images. The study develops automated methods for delineating shelterbelts and models shelterbelt carbon quantities. Object-oriented classification methods are employed to delineate shelterbelts, achieving high classification accuracy. Statistical modelling techniques, specifically random forests, are utilized to differentiate shelterbelt tree species. The study also estimates shelterbelt carbon using field-collected measurements and remotely sensed variables. Results suggest that shelterbelts, primarily comprised of p. Radiata and c. Macrocarpa species, address a critical carbon repository in canterbury, sequestering a normal of 381 tons for every hectare. The study highlights the potential applications of these methods in natural resource management, including assessing shelterbelt effectiveness as wildlife corridors and quantifying the shelterbelt carbon pool across landscapes. Sun et al. (2022) proposes a hybrid prediction model for crude oil futures prices, addressing the challenges of crude oil price forecasting. The study integrates various prediction methods, including chaotic time-series prediction, neural networks, linear models, and deep learning, to enhance accuracy and stability. A new data denoising method is introduced to improve prediction accuracy, demonstrating higher accuracy, efficiency, and robustness compared to control models through simulation experiments. The proposed framework offers valuable insights for accurate point and interval forecasts in crude oil futures pricing. Wang et al. (2022) examine the impact of the Shenzhen Hong Kong stock connect (shsc) mechanism on market volatility in Shenzhen and Hong Kong stock markets. Using generalized auto-regressive conditional heteroscedasticity (garch) models, the study analyses volatility dynamics pre- and post-shsc implementation. Results indicate increased short-term volatility post-opening, enhancing information transmission efficiency between the markets. Moreover, the leverage effect in the Shenzhen market expands, while it decreases in the Hong Kong market, under the influence of shsc. Zhang et al. (2022) propose a model for monthly inflation with stochastic trend, seasonal, and transitory components with qgarch disturbances. They introduce a method to identify heteroscedastic components based on contrasts between autocorrelations of squares and squared autocorrelations of helper residuals. The study demonstrates the effectiveness of this approach in detecting conditional heteroscedasticity, comparing its finite sample performance with that of a LaGrange multiplier test through monte Carlo experiments. Tripathy (2010) investigates the relationship between trading volume and stock returns volatility in the Indian stock market using various arch, garch, and component arch models. The study finds that recent trading volume news can enhance stock price volatility prediction. Moreover, it identifies leverage and asymmetric effects of trading volume, demonstrating that negative news greaterly affects stock cost instability. The review presumes that hilter kilter garch models offer a better fit than symmetric ones. Lin (2018) focuses on the volatility of the sse composite index in the Chinese stock market. Employing garch-type models, the study analyses the index's time-varying and clustering properties, highlighting significant arch and garch effects. Comparing model performance, it concludes that egarch outperforms others. The study suggests strengthening market framework development, lessening unnecessary government mediation, and advancing judicious venture theory to manage market volatility effectively. Cheng et al. (2019) explore the dynamic effects of uncertainty in international crude oil prices on the Chinese economy. Utilizing garch (1,1) models, the study calculates uncertainty measures and investigates their impact on real GDP and investment. Findings indicate that increased oil price volatility decreases GDP and investment, prompting expansionary fiscal and monetary policies. The study also reveals symmetric effects of uncertainty changes on the macroeconomy and highlights regional disparities in economic impact, particularly in eastern China. Zhang et al. (2023) investigate the nonlinear correlations between Chinese stock market volatility, trading volume, and return using a hybrid approach combining the Markov switching regime with the vector autoregressive model (Ms-var). The study identifies three regional systems in the Chinese stock market: steady downward, steady upward, and high volatility, indicating market instability. Findings reveal deviated dynamic connections between market unpredictability, venture return, and exchanging volume across various systems, with a system subordinate contemporaneous relationship among's instability and return. Besides, a positive contemporaneous connection exists among instability and exchanging volumes, suggesting a close relationship between market uncertainty and information inflow.

Qian and Diaz (2017) explore the short-and long-run instability elements between Malaysia's financial exchange and significant financial exchanges across various locales. Utilizing multivariate summed up autoregressive restrictive heteroscedasticity (mgarch) models, including the bekk, ccc, and dcc models, the review researches instability connections. Findings reveal long-term volatility relationships between Malaysia’s stock market and European markets, attributed to trade agreements, while volatility relationships with China’s markets appear unstable. The study underscores the significance of figuring out unpredictability transmission for pursuing informed speculation choices. Ebimobowei and corresponding (2013) investigate the effect of assessment review on charge consistence in Nigeria. Utilizing essential and auxiliary information sources, the review investigations the connection between different types of expense reviews and duty consistence. Results demonstrate a critical connection between irregular, cutoff, and restrictive duty reviews and expense consistence in Nigeria. The review infers that expense review is an effective compliance strategy in Nigeria, recommending improved accountability, transparency, and implementation of tax laws to enhance tax administration. Neenu and Mohamed Nishad (2022) conduct a bibliometric analysis to provide quantitative statistics and review the key influential and intellectual structure of asymmetric volatility and leverage effect in the stock market. Analysing 271 articles and review papers published from 1994 to 2021, the study identifies trends in publication growth and identifies influential authors, journals, institutions, and countries in this field. This study contributes to building a quantitative understanding of the logical advancement of awry unpredictability and influence impact in the securities exchange. Yao et al. (2020) examine the predictability of the stock market using a distribution forecasting approach, contrasting with traditional point forecasting methods. Focusing on the shanghai composite file and the Shenzhen part list, the study employs seven models for distribution forecasting of returns. Results indicate that individual models lack predictive power, but combinations of models show significant directional predictability and profitability. This study introduces a new perspective on stock market predictability and highlights the potential of combined forecasting models. Brooks and burke (1998) employ changed data standards to choose models from the garch family for anticipating us dollar conversion scale bring instability back. Their study finds that selected models demonstrate favourable out-of-sample forecast accuracy compared to the ordinarily utilized garch (1,1) model, especially regarding mean outright mistake. Be that as it may, the garch (1,1) model is chosen less every now and again than different models by the rules applied. Singleton (2001) develops computationally tractable and asymptotically efficient estimators for parameters of affine diffusions and asset pricing models using the known functional form of the conditional characteristic function (ccf). Both time-domain and frequency-domain estimators are constructed, with a method-of-moments estimator displayed to inexact the effectiveness of most extreme probability for relative disseminations and resource evaluating models. Siourounis (2002) investigates the validity of garch-type models over the Athens stock exchange market (ase), an emerging capital market. The study's findings suggest that right detail of various garch models dismisses the frail proficient market speculation for ase. Moreover, experimental proof shows an example in ase where past everyday returns connect with flow returns, unpredictability is emphatically connected with past acknowledge, negative shocks lopsidedly affect day to day stock returns, and political dangers increment instability over an extended time, without changing the mean of the series. Awartani and corradi (2005) compare the out-of-sample predictive ability of various garch models, focusing on the predictive content of the asymmetric component. They conduct pairwise comparisons against the garch (1,1) model using Diebold and Mariano’s (1995) test statistic for non-nested models and Clark and McCracken’s (2001) encompassing tests for nested models. Additionally, a joint comparison against the garch (1,1) model is performed following white's (2000) reality check. Their findings suggest that asymmetric garch models outperform the garch (1,1) model in one-step ahead predictions, with similar results across longer figure skylines, albeit the prevalence of deviated models reduces somewhat. In numerous examinations, the garch (1,1) model is outperformed by deviated garch models however stays serious against other garch models lacking asymmetries. Bollerslev (2023) proposes a natural extension of the arch process introduced by Engle (1982), allowing for past restrictive changes in the ongoing contingent fluctuation condition. The paper determines stationarity conditions and autocorrelation structure for this new class of parametric models and talks about most extreme probability assessment and testing. An experimental model concerning the vulnerability of the expansion rate is introduced to delineate the use of the proposed model. Zheng et al. (2023) explore the synergies among multiple energy sectors in an integrated electricity and heat system (iehs), focusing on distributed energy management in a multi-entity iehs (me-iehs) context. The paper outlines the fundamentals of iehss, defines entities, and establishes various energy the board structures. Appropriated streamlining calculations supporting conveyed energy the executives are efficiently inspected, alongside augmentations to deal with vulnerabilities. Future research directions, including strategic behaviours of multi-stakeholders and distributed learning solutions, are also discussed. Trivedi et al. (2022) investigates the impact of the covid-19 pandemic on volatility patterns in the textile industry in China, particularly focusing on the shanghai stock exchange (sse) composite index. Employing empirical methods such as the symmetric generalized autoregressive restrictive heteroscedastic (garch) (1, 1) model, as well as uneven garch models like egarch and gjr, they expect to recognize unbalanced instability impacts and evaluate the effect of information on the sse composite record. Their review, in light of everyday information from December 19, 1990, to December 31, 2020, adds to the writing on the pandemic's effect on global financial exchanges, explicitly investigating unpredictability designs in the Chinese setting. Najand (2002) compares various forecasting models' abilities to predict daily stock index futures volatility, ranging from naïve models to complex arch-class models. Linear models, particularly autoregressive models, are ranked highest utilizing root mean square blunder (rmse) and mean outright rate mistake (mape) standards. Additionally, three nonlinear models (garch-m, egarch, and ester) are examined, with nonlinear garch models showing dominance over linear models in volatility forecasting, and egarch emerging as the most effective model for estimating stock list fates cost instability. Hou and li (2020) investigate volatility and skewness spillover between the Chinese stock index and index futures markets during the 2015 market crash. They discover significant volatility spillover from futures to spot markets, with futures leading the transmission of downside risk. Furthermore, measures implemented during the accident to control speculative prospects exchanging seem to upgrade overflow from futures to spot markets, offering insights into the effectiveness of such measures in restoring market efficiency during market crises. Loke et al. (2023) present a survey paper reviewing developments in portfolio optimization problem (pop) research from 2018 to 2022. They categorize solution methodologies into metaheuristic, mathematical optimization, hybrid approaches, mat heuristic, and machine learning, discussing their mechanisms and performance. The paper provides insights into emerging trends, preferred techniques, benchmark datasets, and research challenges, aiding researchers in identifying gaps and opportunities in pop research. Owusu junior et al. (2021) investigate lead-slack connections between the Bric stock record and its constituents, along with comovements between the us volatility index (vix) and Bric stock returns. Using bi-wavelet and wavelet multiple correlations approaches, they find high interdependencies between the Bric list and its constituents, with the Bric record noting first to shocks. Likewise, they perceive uni-directional causality between the vix and Bric stocks, proposing suggestions for portfolio broadening and chance administration. Amoako et al. (2022) explore the interdependencies between energy commodities and stock markets of brics countries in the context of volatilities. Utilizing wavelet techniques, they observe stronger positive comovements between energy wares and brics financial exchanges in the long haul, with unpredictability affecting these connections. The review features the huge job of the us unpredictability record in affecting the connection between energy wares and brics securities exchanges, giving bits of knowledge to portfolio risk supporting. Liu et al. (2022) propose a high-dimensional conditional value-at-risk (cover) framework based on the lasso-var model to analyze conditional financial contagion and extreme risk spillovers from oil markets to the g20 stock system. Their approach employs delta covar and covar organizations to analyze risk overflows from both pairwise and foundational viewpoints. They track down critical gamble overflows from oil to g20 stocks during emergency periods, with north American oil-related countries most affected. The study underscores regional and oil-related characteristics in g20 stock contagion, providing policy implications for mitigating systemic risks. Rath (2023) investigates the relationship between asset returns volatility in various segments of the Indian financial markets and macroeconomic shocks. Using data from April 2002 to march 2021, the study identifies the effect of macroeconomic factors like Gross domestic product, expansion, and us depository yield on market steadiness during times of pressure. The findings underscore the importance of maintaining macroeconomic stability to foster financial market stability, emphasizing the need for dynamic monitoring and policy responses tailored to each market segment. Mohapatra et al. (2022) develop ensemble machine learning models to predict stock returns of Indian banks using technical indicators. Utilizing xgboost, gradient boosting, adaboost, and random forest algorithms, the study demonstrates the effectiveness of machine learning in predicting stock market trends. Xgboost outperforms other models, providing valuable insights for traders, investors, and portfolio managers in minimizing dependency on macroeconomic factors and enhancing decision-making in banking stock investments. Usha Kiran et al. (2021) explores the efficiency of environmental, social, and governance (esg) indices in the Indian corporate sector, particularly during the covid-19 pandemic. Analysing nse's esg indices before and after the lockdown, the study finds increased efficiency post-covid-19, indicating investor preference towards esg-compliant companies. This highlights the significance of esg reporting and its impact on market efficiency and investor behaviour. Agnihotri and Chauhan (2022) investigate commodity price risk and its linkage with the Indian stock market. Employing evt-var and delta cover methods, the study examines risk transfer and integration between commodity futures and the nifty index. Results reveal risk move from unrefined petroleum prospects to the financial exchange, emphasizing the importance of risk management strategies and portfolio diversification. Additionally, zinc and natural gas futures exhibit limited integration with the stock market, suggesting potential for diversification benefits. Das and Debnath (2022) investigate the impact of the covid-19 pandemic on stock market volatility spillover in India using equity (Nse exchange) and bond (foreign exchange) indices. Employing the tgarch model (1,1), the review surveys unpredictability changes in the nse stock trade and sectoral records. The discoveries recommend a negative and genuinely critical relationship, showing a diminishing in securities exchange unpredictability in India following the Coronavirus episode. Also, the review uses vector autoregressive-baba, Engle, kraft, and kroner with multivariate garch (var-bekk-garch model) to investigate unpredictability overflow impact from worldwide files, for example, Nasdaq, Nikkei 225, and ftse100, with clever and Nasdaq showing the biggest and longest-term overflow impacts. Tripathi (2021) investigates the impact of information arrival on prices for 21 major global market indices spanning from 1998 to 2018, utilizing quantile regression methodology. The study reveals a contemporaneous and causal impact of volume on returns, demonstrating orderly extensive data discharge that is consumed by members over short skylines, prompting uniform assumptions and lower unpredictability levels. The heterogeneous impact of volume on return across contingent quantiles reflects differentiating designs in the transmission of positive and negative news, especially articulated during focused energy data appearance, lining up with the combination of circulation speculation and data deviation speculation. Setiawan and kartiasih (2021) aim to test the disease impact from the Argentina and turkey emergencies to Asian nations utilizing the dcc-mgarch model. Everyday shutting file stock cost information from Thomson Reuters DataStream covering January 2, 2014, to May 17, 2019, is utilized. Discoveries demonstrate virus impacts from the Argentina emergency in Malaysia, Korea, Thailand, and the Philippines, while Indonesia, Singapore, India, and China display reliance. Likewise, virus impacts from the turkey emergency are seen in Indonesia, Malaysia, the Philippine's, Thailand, India, and China, with Singapore and Korea showing reliance with the Turkish market. Kola and sebehela (2021) explore the structural break points of returns and volatility in indices using integral transforms (Fourier and LaPlace) and common unit root structural break tests (adf, gls, pp, za). The study validates the interchangeability of structural break points and illustrates persistent interconnectedness patterns throughout the time series. The results from structural break point tests confirm the findings of integral transforms, providing insights into the dynamics of structural breaks in time series data.

1.3 RESEARCH GAPS

1.Comparative Study Gap: There's no research comparing how well GARCH analysis measures volatility and risk in NASDAQ investments compared to other methods.

2.Decision-Making Knowledge Gap: We don't know enough about how GARCH findings affect when traders decide to buy or sell options. This includes understanding how traders use GARCH predictions when they hear good or bad news about the market.

3.Policy Implementation Missing: The research doesn't look into how governments use GARCH data to make rules during unstable market times. We need to see if there's a direct link between GARCH forecasts and the rules governments make.

4.Investor Behaviour Gap: We haven't studied how GARCH analysis affects how confident investors feel and how much they invest. Understanding this could help us see how GARCH affects the economy.

5.Practical Use Case Shortage: There aren't enough real-life examples showing how GARCH analysis guides actual trading and government decisions. Looking at different cases could help us understand how well GARCH works in different situations.

1.4 OBJECTIVE

For Investors:

1.Use GARCH to know how risky NASDAQ investments might get.

2.Helps decide when to buy or sell options based on expected ups and downs. Understanding Market Behaviour. GARCH shows how good or bad news affects future risks differently.

3.Helps get ready for big market swings.

For Policymakers:

1.Market Stability: ARCH helps spot times when the market might get too wild. Make rules to keep the market steady during shaky times.

2.Investor Confidence: Showing that policymakers understand market risks makes investors feel safer. More investor trust means more investment and a stronger economy.

3.Regulatory Framework: GARCH info guides making rules that keep banks and investors safe. Helps make sure everyone plays fair in the market.

1.5HYPOTHESIS

H1: GARCH analysis will reveal the extent of volatility and associated risk in NASDAQ investments.

H 2: GARCH insights will aid in pinpointing the optimal timing for buying or selling options.

H 3: Market Volatility and Risk Assessment: GARCH analysis will reveal the level of volatility and associated risk in NASDAQ investments. Higher volatility periods will indicate increased risk levels for investors.

H 4: Timing for Option Trading Decision Making: Differential effects of positive and negative news on future market gambles will influence traders' decisions regarding option transactions.

H 5: Market Stability Monitoring: Policymakers will utilize GARCH to identify periods of market instability. Regulatory interventions will be designed to maintain market stability during turbulent times.

H 6: Enhancing Investor Confidence: GARCH analysis will demonstrate policymakers' understanding of market risks. Increased investor confidence will lead to higher investment activity and contribute to a stronger economy.

2.RESEARCH METHODOLOGY-:

This part revolves around the showing approaches of eccentricism, and the fundamental characteristics of each model. In the early investigates on monetary trade capriciousness, the excellent econometric models are by and large established anyplace close by of independence between the disturbing things of benefits rate and the invariance of contrasts. While with the creating of money related speculation and trial assessment, people track down the gathering thought of monetary trade flightiness, to be explicit, colossal fluctuations are regularly joined by huge ones, and little instabilities are a large part of the time around comparable degree ones. Also, the difference of unpredictability portion not stay steady, yet consistently changing (Armstrong and Fildes, 1995). Since the static model (like standard deviation technique) has characteristic disfigurements, and these defects become more undeniable especially in the examination of protections trade eccentricism. Hence, analysts were in extending number endeavoring to use new procedures to analyze the issue of protections trade unconventionality. Engle proposed the Bend model in the year 1982, to portray the qualities of capriciousness' assortment. This model has later been extensively ap dealt with to the examination of money related time series. In 1986, Bollerslev extended this model, and made it to a more summarized structure, the GARCH model. On reason of the GARCH model, Engle, Lilien and Robins relaxed the condition that the mean of series should be independent with the distinction, loosening up GARCH model to the GARCH-M model. These three models depend on the explanation of uniformity risks and benefit, while in the certified market, the speed of return on asset of the monetary trade will overall be veered off. That is the level of impact of uplifting news and awful news on the resource yields in various (Creeks and Burke, 1998). To advancement dress this issue, Zakoian's TARCH model and Nelson's EGARCH model give the looking at game plans. The two models consider the time-fluctuating part of precariousness contrast, and they might even more at any point totally reflect the qualities of the capital market. Consequently, they have transformed into the critical showing gadgets for the investigation in financial econometrics locale.

2.1 ARCH model

the basic idea of ARCH model is that at a certain point, under the collection of all information in the past, the occurrence value of a noise is normally distributed (Wang et al, 2010). The dispersion has a mean of 0. Its change is the line ar blend of the square of restricted clamor values previously (reflects auto relapse), and it is a period differing sum (reflects contingent heteroscedasticity ty). Curve model has an essential structure as follows:

$$\{r_t = f(t, r_{t-1}, r_{t-2}, \dots) + \varepsilon_t, \varepsilon_t = \sqrt{h_t e_t}, h_t = \omega + \sum_{j=1}^{q} \quad \lambda_j \varepsilon_{t-j}^2, \tag{1}$$

This is the q order autoregressive conditional heteroscedasticity model, abbreviated as ARCH (q). Where the D refers to daily return of stock index; D is the i order lagged variable (i= 1, 2…); D is the autorepression function of D; D is a random error series, under the collection of all information in the past, it is sub jects to a normal distribution with a mean of 0 and variance D (conditional variance); D is a series of white noise, each D is independent and identically dis tributed, and subject to normal distribution; D is the coefficient of conditional variance equation, D> 0, D >0 (j=1,2…q), ∑ D

2.2 Symmetric GARCH model

ARCH model provides a brief and efficient way of analysis in describing the changeable volatility of financial time series. Instead of assuming a constant variance like other traditional econometric models, ARCH treats conditional variance as transformable with time. While in practice, 'the application of ARCH model of ten requires a larger order, which will not only increase the number of parameters to be estimated, but also lead to other problem, such as the multicollinearity of ex planatory variables' (Asteriou and Hall, 2011). To address the existing problems in ARCH model, Bollerslev extended it by adding an autoregressive term to get the GARCH model. The simplest GARCH model is the GARCH (1, 1):

$$R_t = a_0 + a_1 R_{t-1} + \varepsilon_t \tag{2}$$

$$\varepsilon_t \sim iidN(0, \sigma_t^2)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-j}^2 \tag{3}$$

Equation (2) is a mean equation of exogenous variables and mean of error. Equation (3) gives a function of 1) a constant, 2) volatility of the last period ε_{t-1}^2 period σ_{t-1}^2 (GARCH part). σ_t^2 is a prediction variance based on the information of previous periods. Besides, the first '1' in the brackets means the GARCH part with order 1, the second '1' in brackets means ARCH part with order 1. A special form of GARCH model is the ordinary ARCH model.

The higher order of GARCH model can be denoted as GARCH (p, q), where the 'p' or 'q' is the order greater than 1. The variance equation of it can be ex pressed as:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 \quad (4)$$

Where p, q are the order of GARCH part and ARCH part respectively ($p \geq 0, q > 0$). $\omega > 0, \alpha_i \geq 0 (i = 1,2, \ldots, q), \beta_j \geq 0 (j = 1,2, \ldots, p)$ and $\sum_{i=1}^{q} \alpha_i + \sum_{j=1}^{p} \beta_j$ is the attenuation coefficient, which reflects the volatility persistence. When $\sum_{i=1}^{q} \alpha_i + \sum_{j=1}^{p} \beta_j < 1$, GARCH process is stationary.

In general, the GARCH (p, q) model has been able to simulate the asset yield sequence and implied volatility sequence. However, they fail to take into account the long-term memory and asymmetry of volatility, and long-term memory is widespread within the stock and foreign exchange market. Asymmetry is also an important feature in stock market volatility.

2.3 ARCH-M model

If introducing the conditional variance into equation (2), we can get the ARCH-M model (Engle, Lilien and Robins, 1987):

$$R_t = a_0 + a_1 R_{t-1} + \beta \sigma_t^2 + \varepsilon_t \quad (5)$$

ARCH-M model is usually applied in the research about relation between ex pected return and expected risk of capital. The estimated coefficient of the ex pected risk is a trade-off between risk and return. If the conditional variance is re placed by conditional standard deviation, we can get another form of ARCH-M model.

2.4 Asymmetric GARCH model

The vertical development in resource costs is in many cases joined by a more grounded level of descending development, this is a typical peculiarity in the monetary business sectors. To make sense of this peculiarity, Engle and Ng (1993) drew deviated data bends affected by uplifting news and affected by terrible news re spectively. The lopsided impact is the essential sign of the market's response to shocks. It is otherwise called 'influence impact', which is a significant trait of numerous monetary resources. In the capital market, market examiners frequently find that the stock cost development likewise exists the lopsided impact, which is the way that when a stock experiences an effect of negative shocks, its unpredictability is a lot fiercer than that brought about by sure shocks. Since a critical decrease in the stock cost diminishes the interests of investors, expanding the gamble of holding this organization's stock. TARCH and EGARCH are the really two models portraying such topsy-turvy stuns.

(1) EGARCH Model

Straight GARCH model expects that the positive shocks and negative shocks with equivalent outright qualities cause similar level of stock cost changes, in particular the contingent differences are something very similar. Notwithstanding, in actuality, particularly in the monetary business sectors, the positive and negative shocks with equivalent outright qualities frequently cause various levels of vacillations. Since in the financial exchange, the degree of offer cost decline will in general be a lot bigger than the offer cost rise, and the fall cycle is by all accounts more vicious and unstable. Thus, the imbalance impact in securities exchange unpredictability has been past the logical force of the direct GARCH models. Nelson (1991) proposed Exponential GARCH model, namely EGARCH model, on basis of the GARCH model, he improved the model to:

$$R_t = \beta_0 + \beta_1 R_{t-1} + \varepsilon_t \quad (6)$$

$$ln\, ln\left(\sigma_t^2\right) = \alpha_0 + \sum_{i=1}^{q} \left(\alpha_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \gamma_i \left(\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right)\right) + \sum_{j=1}^{p} \left(\beta_j\, ln\, ln\, \sigma_{t-j}^2\right) \quad (7)$$

The left-hand side of the equation logD is the logarithmic form of the conditional variance, which means the impact of leverage effect is not quadratic but ex ponential, so that the predicted value of the conditional variance must be non-negative. We can test for leverage effect by examining the coefficient D. If y1=y2=…=0, then the stock price's response to news impact does not have symmetric effect; if D 0, then asymmetric effect is existed or the impact of bad news to the market is greater than the good news; if D 0, then asymmetric effect is existed, but the impact of bad news is smaller than the good ones' (Asteriou and Hall, 2011). The upside of this model is that the information of contingent fluctuation D appear as logarithm. Consequently, it requires no limitations to different boundaries of the recipe, which makes the tackling system less difficult and more adaptable.

The EGARCH (1,1) has the following form:

$$ln(\sigma_t^2) = \alpha_0 + \beta ln(\sigma_{t-1}^2) + \alpha \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad (8)$$

Where, σ_{t-1}^2 = previous period's variance estimation, it scales how persistent the conditional variance of the previous period is; $\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|$ = impact of volatility from the last period; $\frac{\varepsilon_{t-1}}{\sigma_{t-1}}$ = the effect of leverage and asymmetry.

In addition, Engle and Ng (1993) pointed that, when the volatility suddenly appears and then quickly disappears, the predictive ability of EGARCH model will be greatly reduced.

(2) TARCH Model

Threshold GARCH model was introduced by Zakoian (1990) and Glosten, Jafanathan and Runkle (1993), which is designed to detect the leverage effect in the financial market. To accomplish this, essentially by adding a multiplicative faker variable into the fluctuation condition to make sure that when shocks are negative whether there exists genuinely huge contrast. Furthermore, it is under the suspicion that unforeseen data shocks can influence the unpredictability of stock returns. The type of the model can be indicated as :

$$R_t = a + bR_{t-1} + \varepsilon_t \quad (9)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} (\alpha_i \varepsilon_{t-i}^2) + \gamma \varepsilon_{t-i}^2 d_{t-1} + \sum_{j=1}^{p} \beta_i \sigma_{t-j}^2 \quad (10)$$

When D < 0, D=1; otherwise, $d_{t=0}$. The coefficient D represents the impact of positive shocks, and the coefficient D D represents the impact of negative shocks. Therefore, when α is greater than 0, the impact of the 'bad news' is great er than 'good news', we get asymmetric effect. And when D equals to 0, there would be no leverage effect. Besides, TGARCH (1,1) has the form of:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-i}^2 d_{t-1} + \beta_1 \sigma_{t-1}^2 \quad (11)$$

What's more, the ideal unpredictability assessment model for the Nasdaq record ought to breeze through the Ljung-Box Q assessment and the Curve LM test. Also, this is based on least Akaike Data Rules (AIC) and least Schwarz Data Measures (SIC).

2.5 Data Collection

The information for this study are the everyday shutting costs of Nasdaq Record over the period stretching out from July 26, 2013 to July 28, 2017, disclosing all out perceptions of 978 barring occasions. Furthermore, the last week information of July 2017 will be utilized to test the expectation consequences of the three models. Other than these information series are gathered from Wind data set.

The financial exchange returns in this paper are accumulated as intensified returns:

$$R_i = ln\, ln \left(\frac{P_i}{P_{i-1}}\right) \quad (12)$$

Where P_i is the day to day shutting record of SSE composite list at days t, and $P_i - 1$ is the file at days t-1.

RESULTS & DISCUSSION

3.1 Descriptive statistical analysis

Figure3-1

Before we start digging into the data, it's important to understand some basic stats about it. Figure 3-1 shows a graph of how much the Nasdaq index goes up or down each day. We're using a software called EViews 12 to help us with all the steps in our analysis.

Looking at the graph, we can see that the Nasdaq index doesn't just move randomly. It seems to follow a pattern over time, and some days it moves more than others. This means that simple models that assume the same amount of movement every day don't work well here. Instead, we need to use more advanced models like GARCH, which are good at handling this kind of changing volatility.

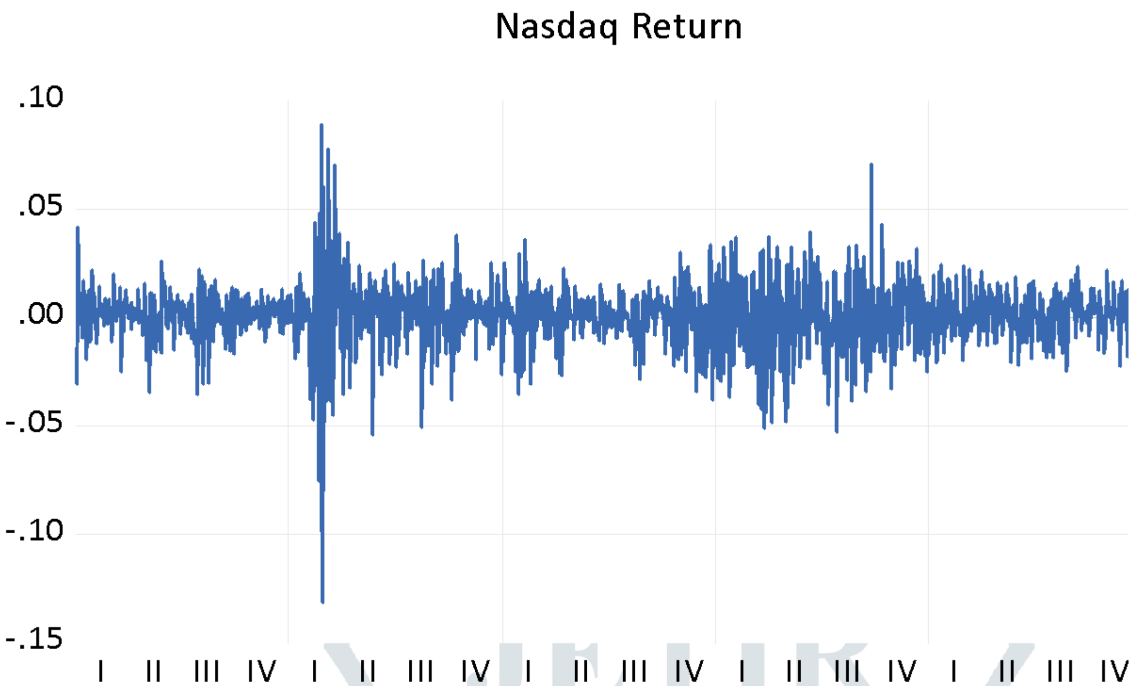

Fig.3-2. Line chart of daily Nasdaq index returns

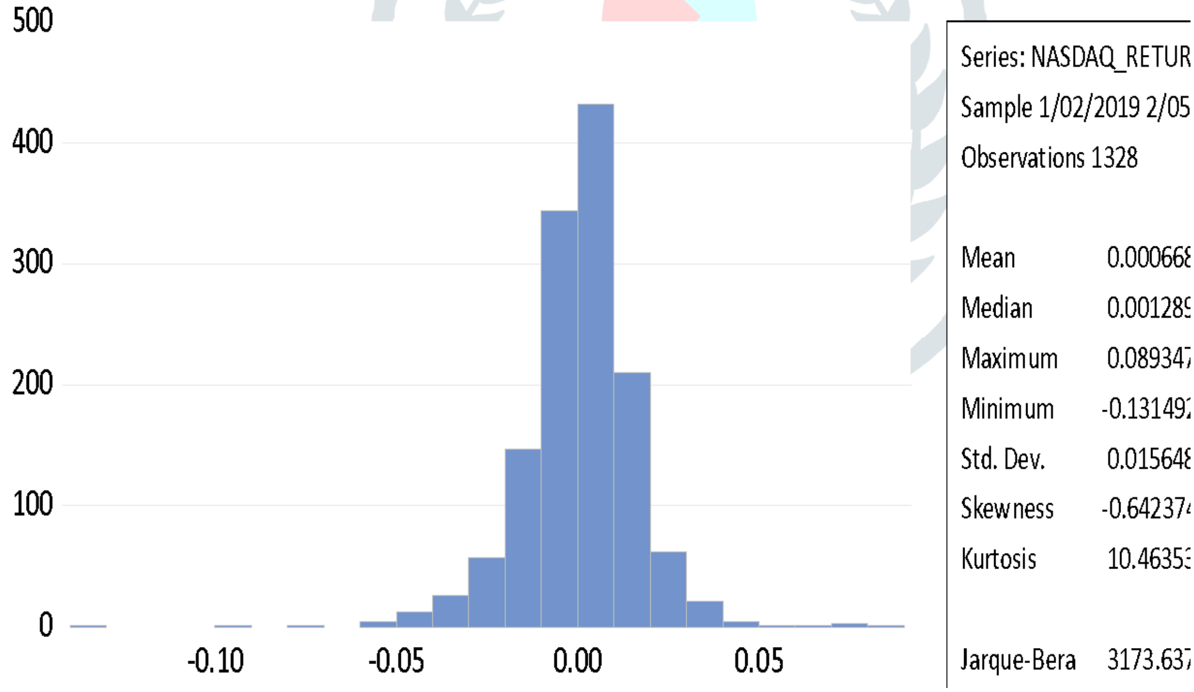

Figure 3-3 Nasdaq

3.2 GARCH IN MEAN MODEL:

Dependent Variable: NASDAQ_RETURN

Method: ML ARCH - Normal distribution (Marquardt / EViews legacy)

Date: 04/13/24 Time: 21:08

Sample (adjusted): 1/04/2019 2/05/2024

Included observations: 1327 after adjustments

Convergence achieved after 18 iterations

Presample variance: back cast (parameter = 0.7)

GARCH = C(4) + C(5)RESID(-1)^2 + C(6)GARCH(-1)

Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
GARCH	1.351752	2.557980	0.528445	0.5972
C	0.001007	0.000451	2.232028	0.0256
NASDAQ_RETURN (-1)	-0.060924	0.028874	-2.109981	0.0349
Variance Equation				
C	4.84E-06	1.29E-06	3.767685	0.0002
RESID (-1) ^2	0.136332	0.019121	7.129838	0.0000
GARCH (-1)	0.845131	0.019114	44.21419	0.0000

Other Statistics

Statistic	**Value**
R-squared	0.012778
Adjusted R-squared	0.011287
S.E. of regression	0.015541
Akaike info criterion	-5.847895
Sum squared resid	0.319776
Schwarz criterion	-5.824425
Log likelihood	3886.078
Hannan-Quinn criter.	-5.839098
Durbin-Watson stat	2.161609

The output indicates that this is a GARCH (1,1) model, which means the conditional variance of NASDAQ returns (h_t) is estimated using:

- A constant term: 1.351752

- The squared residual from the previous period (resid^2(t-1)) with a coefficient of 0.136332
- The lagged GARCH term (GARCH(t-1)) with a coefficient of 0.845131

Equation of the GARCH Model:

h_t = 1.351752 + 4.84e-06 + 0.136332 resid^2(t-1) + 0.845131 GARCH(t-1)

Interpretation of the Coefficients:

- The constant term (1.351752) represents the minimum level of volatility even when there are no recent shocks (i.e., squared residuals).
- The coefficient on the squared residual (0.136332) suggests that a 1% increase in the squared residual from the previous period (resid^2(t-1)) leads to a 0.136332 increase in the conditional variance in the current period (h_t). This implies that the model captures the persistence of volatility, where larger shocks in the past tend to be followed by larger volatility in the future.
- The coefficient on the lagged GARCH term (0.845131) indicates that 84.51% of the conditional variance in the previous period (GARCH(t-1)) is carried over to the current period (h_t). This high coefficient suggests that the GARCH (1,1) model effectively captures the volatility clustering in NASDAQ returns, where periods of high volatility tend to be followed by periods of high volatility.

It is important to note that the p-value of the lagged GARCH term (0.5972) is greater than the conventional significance level of 0.05. This suggests that the coefficient on the lagged GARCH term might not be statistically significant. This could potentially indicate that the GARCH (1,1) model might be mis specified, and a more complex model might be needed to capture the volatility dynamics of NASDAQ returns.

Overall, the GARCH (1,1) model provides a reasonable starting point for modelling the conditional variance of NASDAQ returns. However, the lack of statistical significance for the lagged GARCH term suggests that further investigation into alternative GARCH model specifications might be necessary.

3.3 Unit Root Heteroskedasticity Test: ARCH

Lag	Autocorrelation (AC)	Partial Correlation (PAC)	Q-Stat	Probability (Prob)
1	0.015	0.015	0.3179	0.573
2	-0.009	-0.009	0.4268	0.808
3	-0.038	-0.038	2.3614	0.501
4	-0.007	-0.005	2.4180	0.659
5	-0.001	-0.002	2.4198	0.789
6	-0.046	-0.048	5.2505	0.512
7	0.033	0.034	6.6989	0.461
8	0.004	0.002	6.7219	0.567
9	0.074	0.071	14.059	0.120

Lag	Autocorrelation (AC)	Partial Correlation (PAC)	Q-Stat	Probability (Prob)
10	-0.002	-0.002	14.064	0.170
11	0.020	0.022	14.607	0.201
12	-0.025	-0.023	15.463	0.217
13	-0.038	-0.033	17.406	0.181
14	0.030	0.032	18.626	0.180
15	-0.058	-0.056	23.138	0.081
16	0.005	-0.000	23.172	0.109
17	-0.031	-0.029	24.447	0.108
18	0.072	0.061	31.343	0.026
19	-0.009	-0.014	31.457	0.036
20	0.012	0.015	31.656	0.047
21	0.046	0.047	34.453	0.032

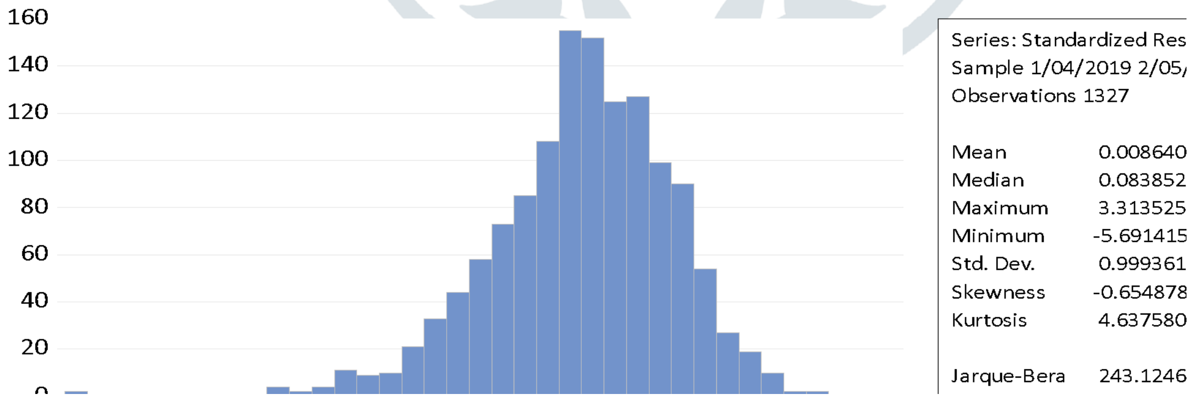

Figure 3-4 chart

3.4 Diagnostics checks:

1.Test: ARCH Test

Results:

Test	Value	Interpretation
F-statistic	148.8933	Highly significant with p-value = 0.0000
Prob. Chi-Square (1)	0.0000	Highly significant
ObsR-squared	134.0440	Highly significant with p-value = 0.0000

RESULTS :

results indicate strong evidence of non-constant variance of the residuals in the regression model, suggesting heteroskedasticity. meaning the variability of the residuals changes as the observed values change.

2.Engle-Ng Sign Bias Test

Null Hypothesis	t-Statistic	Prob.
Sign-Bias	1.037427	0.2997
Negative-Bias	0.765615	0.4440
Positive-Bias	-0.062929	0.9498
Joint-Bias	1.558546	0.6689

Test Equation

Dependent Variable: RESID^2

Method: Least Squares

Date: 04/13/24 Time: 21:31

Sample (adjusted): 1/07/2019 2/05/2024

Included observations: 1326 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.953343	0.103558	9.205918	0.0000
SMINUS (-1)	0.152383	0.146885	1.037427	0.2997
SMINUS (-1) RESID (-1)	4.725558	6.172241	0.765615	0.4440
SPLUS (-1) RESID (-1)	-0.458560	7.286958	-0.062929	0.9498

3.5 Estimation of GARCH (1, 1) model squared root transformation

Dependent Variable: NASDAQ_RETURN
Method: ML ARCH - Normal distribution (Marquardt / EViews legacy)
Date: 04/13/24 Time: 12:05
Sample (adjusted): 1/04/2019 2/05/2024
Included observations: 1327 after adjustments
Convergence achieved after 12 iterations
Presample variance: back cast (parameter = 0.7)

GARCH = C (3) + C (4) RESID (-1) ^2 + C (5) GARCH (-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@SQRT(GARCH)	0.063380	0.084223	0.752522	0.4517
C	0.000499	0.000968	0.515636	0.6061
NASDAQ_RETURN (-1)	-0.060723	0.028872	-2.103149	0.0355
	Variance Equation			
C	4.90E-06	1.30E-06	3.774209	0.0002
RESID (-1) ^2	0.137014	0.019186	7.141505	0.0000
GARCH (-1)	0.844194	0.019304	43.73206	0.0000

R-squared	0.012558	Mean dependent var	0.000691
Adjusted R-squared	0.011067	S.D. dependent var	0.015629
S.E. of regression	0.015543	Akaike info criterion	-5.848104
Sum squared resid	0.319848	Schwarz criterion	-5.824634
Log likelihood	3886.217	Hannan-Quinn criter.	-5.839307
Durbin-Watson stat	2.163215		

Interpretation of the Coefficients:

- The constant term (0.063380) represents the square root of the minimum volatility level. Squaring it would give you the minimum level of variance even when there are no recent shocks. (Note: p-value is high, indicating potential lack of significance)
- The coefficients for the squared residual (0.137014) and lagged GARCH term (0.844194) are similar to the standard GARCH model. They capture the effect of past shocks and volatility persistence, but the interpretation is with respect to the square root of the variance.

Transformation and Model Choice:

- Transforming the variance equation with a square root helps achieve normality in the residuals, which is often a requirement for GARCH models.
- This specific model selection (GARCH with square root transformation) might be chosen due to the presence of non-negative residuals (volatility can't be negative).

This GARCH (1,1) model with a square root transformation captures the volatility dynamics of NASDAQ returns. However, the lack of significance for the constant term and the need for post-processing the results for variance analysis warrant further investigation.

3.6 Asymmetric Effect (EGARCH):

Dependent Variable: NASDAQ_RETURN
Method: ML ARCH - Normal distribution (Marquardt / EViews legacy)
Date: 04/13/24 Time: 21:24

Sample (adjusted): 1/04/2019 2/05/2024
Included observations: 1327 after adjustments
Convergence achieved after 20 iterations
Presample variance: back cast (parameter = 0.7)
LOG(GARCH) = C (3) + C (4) ABS (RESID (-1)/@SQRT (GARCH (-1))) + C (5)
RESID (-1)/@SQRT (GARCH (-1)) + C (6) LOG (GARCH (-1))

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000591	0.000328	1.801226	0.0717
NASDAQ_RETURN (-1)	-0.055656	0.028790	-1.933175	0.0532
	Variance Equation			
C (3)	-0.511451	0.075352	-6.787460	0.0000
C (4)	0.216412	0.030889	7.006087	0.0000
C (5)	-0.105866	0.012358	-8.566649	0.0000
C (6)	0.960454	0.007188	133.6248	0.0000

R-squared	0.014332	Mean dependent var	0.000691
Adjusted R-squared	0.013588	S.D. dependent var	0.015629
S.E. of regression	0.015523	Akaike info criterion	-5.870507
Sum squared resid	0.319273	Schwarz criterion	-5.847037
Log likelihood	3901.081	Hannan-Quinn criter.	-5.861710
Durbin-Watson stat	2.184309		

3.7 Estimation of EGARCH (1, 1) model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000755	0.000338	2.237512	0.0253
NASDAQ_RETURN (-1)	-0.053973	0.030000	-1.799094	0.0720
	Variance Equation			
C	5.63E-06	1.17E-06	4.806565	0.0000
RESID (-1) ^2	0.044084	0.020597	2.140360	0.0323

RESID (-1) ^2(RESID (-1) <0)	0.138576	0.021480	6.451337	0.0000
GARCH (-1)	0.857068	0.018773	45.65378	0.0000

R-squared	0.014062	Mean dependent var	0.000691
Adjusted R-squared	0.013318	S.D. dependent var	0.015629
S.E. of regression	0.015525	Akaike info criterion	-5.863429
Sum squared resid	0.319360	Schwarz criterion	-5.839959
Log likelihood	3896.385	Hannan-Quinn criter.	-5.854632
Durbin-Watson stat	2.188027		

where I(resid(t-1) < 0) is an indicator function that equals 1 if the previous residual (resid(t-1)) is negative and 0 otherwise.

3.8Discussion

In financial modelling, diagnostic checks are like health check-ups for our models. They help us see if our models are good enough to predict how the NASDAQ market will behave.

One check is called the Heteroskedasticity Test. It looks at whether the errors in our model stay the same over time. If they don't, it means our model might not be reliable. So, we might need to use fancier models called GARCH models.

GARCH models are like special tools that help us understand how the market's ups and downs affect each other. We have different types of GARCH models, each with its own way of looking at things. Some focus on how past changes affect future ones, while others look at how positive and negative changes are different.

After using these models, we look at the numbers they give us. We try to understand what each number means. For example, some numbers tell us how much past changes affect future ones, and others tell us if the market's behaviour is different when it's going up or down.

We also do other checks to make sure our model is working well. These checks help us see if there's a pattern in our predictions that we might be missing.

By doing all these checks, we make sure our models are doing a good job of predicting how the NASDAQ market will move. This helps us make better decisions about how to manage risks and make investments.

Implications and Considerations:

The interpretation of the coefficients needs to consider the logarithmic transformation. Changes in the log variance translate to exponential changes in the actual variance.
This model provides insights into the dynamics of log volatility, but you might need to transform the results back to the original variance scale (by exponentiating) for some analyses.

Implications of GARCH Models for Investors and Policymakers

The GARCH models investigated here presented all offer valuable insights for investors and policymakers regarding volatility in the NASDAQ market.

For Investors:

- **Risk Management:** All GARCH models can be used to estimate future volatility, which helps investors assess the potential risk associated with holding NASDAQ assets. This information can be used to:

- Develop appropriate investment strategies based on risk tolerance.
- Set stop-misfortune orders to restrict possible misfortunes during times of high instability.
- Allocate assets strategically across different asset classes to manage overall portfolio risk.

- **Option Pricing:** The models can be used to estimate the implied volatility used in option pricing models. This allows investors to:
  - Value stock options more accurately.
  - Make informed decisions about buying or selling options based on their perceived volatility.

- **Understanding Market Behaviour:** The GARCH (1,1) with EGARCH effects provides the most nuanced understanding of volatility dynamics. It highlights the asymmetric effect (leverage effect) where negative shocks can significantly increase future volatility. This can help investors:
  - Be prepared for potential periods of heightened volatility following significant market downturns.
  - Adjust their investment strategies accordingly to mitigate potential losses.

For Policymakers:

- **Market Stability:** Understanding volatility dynamics is crucial for policymakers aiming to maintain financial stability. The GARCH models can help them:
  - Identify potential periods of excessive volatility that could disrupt the market.
  - Develop policies to mitigate systemic risk and prevent financial crises.
  - Implement measures to increase market resilience to sudden shocks.

- **Investor Confidence:** By demonstrating an understanding of market volatility, policymakers can boost investor confidence. This can lead to:
  - Increased investment activity and economic growth.
  - A more stable financial system overall.

- **Regulatory Framework:** The insights from GARCH models can inform the development of a regulatory framework that addresses:
  - Capital adequacy requirements for financial institutions to ensure they can withstand periods of high volatility.
  - Risk management practices for market participants to promote responsible investment behaviour.

LIMITATIONS

General Considerations:

- It's important for both investors and policymakers to acknowledge the limitations of GARCH models. They are based on historical data and might not perfectly predict future volatility, especially during unforeseen events.
- Investors should not rely solely on GARCH models for investment decisions but rather integrate this information with other fundamental and technical analysis techniques.
- Policymakers should use GARCH models in conjunction with other economic and financial indicators to develop effective policies.

By understanding the ramifications of these GARCH models, financial backers can go with informed choices to oversee risk and possibly accomplish their monetary objectives. Policymakers can use these bits of knowledge to advance a more steady and strong monetary framework.

CONCLUSION

While GARCH models offer significant insights, it's essential to acknowledge their limitations. They provide a framework for understanding volatility dynamics but may not capture all aspects of market behaviour. Therefore, integrating GARCH insights with other analytical approaches is crucial for comprehensive risk management and policy making.

Our examination of the NASDAQ stock market's behaviour over time has provided valuable insights into market volatility. Through the application of various mathematical tools, we have observed how unpredictable fluctuations in the market can influence future volatility.

Our analysis revealed that adverse events, such as declines in stock prices, tend to exacerbate future volatility, contributing to increased uncertainty for investors. By rigorously scrutinizing our mathematical models, we have ensured the reliability of our findings.

However, while these tools offer valuable predictive capabilities, they do not provide a comprehensive understanding of market dynamics. Therefore, it is essential to complement quantitative analyses with qualitative insights to gain a more holistic perspective.

Our study underscores the significance of managing volatility in the market to facilitate informed decision-making by investors and promote stability. By leveraging these mathematical tools alongside other analytical approaches, we can navigate the complexities of the market landscape more effectively.

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