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Research Article

Exploring Interactions Between Gold Exchange-Traded Funds and Nifty 50 ETF, Weighted Fund ETF, And Sensex ETF

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ABSTRACT

This research sets out to unravel complex dynamics between Gold Exchange-Traded Funds (ETFs) and three critical indices in the Indian financial market, namely Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF. Employing structural equation modeling with ML estimation for over a period of ten years, the study seeks to establish the complex relationship between Gold ETF and the returns of these selected indices.

The estimated negative effects were slight and not significant for Nifty 50 ETF and Weighted Fund ETF while for Sensex ETF the results were positive but insignificant leading to questioning of the presumed diversification advantage of Gold ETFs in these contexts. As such, complementing the existing literature, the study provides additional and more detailed information about Gold ETF, noting the necessity to study its connections with other important ETFs in further detail.

Keywords: Gold Exchange-Traded Funds, Nifty 50 ETF, Weighted Fund ETF, Sensex ETF

Introduction

This paper argues that due to the increasing complexity of the financial markets, investors are always in search of diversified and effective investment portfolios and that Exchange-Traded Funds (ETFs) have emerged as the most important tools for the investors. ETFs are intended to replicate the movement of certain specific indexes, giving the investor an easy way to invest in the various sectors and classes of assets. In the vast universe of ETFs, Gold ETFs have received specific interest because of the options they provide to investors as a defensive tool against market volatility.

This research aims at exploring the multiple connections that exist in the Indian financial market, with Gold ETF as an independent variable and Dependent variable being Nifty 50 ETF, Weighted Fund ETF and Sensex ETF. The purpose is to explain the relationships between these ETFs and evaluate how decision to incorporate Gold ETF in the portfolio affects the other significant ETFs in the circumstances of India.

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Research Article

Therefore, the rationale for testing the effects of Gold ETF to the returns of Nifty 50 ETF, Weighted Fund ETF and Sensex ETF stems from the increasing importance of gold as an asset class to the changing investment environment in India. Gold, which people have always associated with safety and stability, has a peculiar tendency during some market crises as well as during other unfavorable situations. Gold is sought by investors for reasons of diversification and as an inflation hedge and a hedge against any unanticipated events.

The Nifty 50, weighted fund, and Sensex ETFs are portfolios that contain the stocks that reflect the market or sector indices. It is here that the behaviour of the inclusion of Gold ETF in a portfolio with the returns of these well monitored indices is of paramount importance to investors and portfolio managers looking at maximizing risk and return.

The research findings have important implications for different actors in the financial system. The study will be useful to investors interested in information on the diversification opportunities provided by Gold ETFs in light of the opportunities in the Indian market. Investment portfolio holders including portfolio managers and financial advisors may find useful information on how to build sound and diversified investment portfolios using the relationship between gold and popular stock market indices.

At the same time, the results offer valuable insights that can support the evolution of financial research and help to outline the further development of relations between traditional and non-traditional assets in emerging markets. The study intends to contribute a basic understanding of the influence of Gold ETF on major Indian ETFs so as to help in decision-making in the area of asset management and investment plan.

Review of literature

Taking on a similar topic, Tandon et al., (2022) examined the sustainability of Exchange Traded Funds (ETFs) in the Indian stock market exchanges and its impact on market performance. Their study was published in IPE Journal of Management and it looked at the various issues that are likely to influence the sustainability of ETF and its effects on the market in great detail. While examining the performance indices, Tandon et al. (2022) brought into light a more complex understanding of the future sustainability of ETFs in the Indian stock exchanges. Consequently, the research offers a valuable input in the current debate on financial sustainability and investment approaches for stakeholders.

Kaur and Bhatia (2021) examined the performance of gold Exchange-Traded Funds (ETFs) in India before and after the COVID-19 pandemic. The paper was instrumental in offering a better understanding of how disruptions and shifts in the global economy, and investors' behaviour during the pandemic impacted the gold ETF space. The specific work of Garg helps to reveal how gold ETFs has proved to be a safe haven, which does not require much change during the crisis. It is possible for investors to use these findings to grasp the special characteristics of gold ETFs in the course of an economic crisis, which in turn can help them make better investment decisions.

This paper built on Agarwal's (2022) study that examined investor preferences towards various forms of gold during the pandemic to understand how the circumstance of the pandemic impacted the investors' preference for various form of gold as a safe-haven asset. The investigation adds to the knowledge of the nature and causes of investor behaviour during crises and the investment strategies in such environments. This research provides investors with useful knowledge about various forms of gold and helps them develop long-term strategies to invest in gold in the period of economic difficulties.

Death and infection rates related to COVID-19 cases were examined by Gaba and Kumar (2021) in the context of the Indian Gold Exchange-Traded Funds and the results showed how the market reacts to such events. In addition to expanding the knowledge of public health crises and financial markets

Research Article

interconnection, the study provided a rich view of how investors manage risks. The above work enables investors to be sensitive to changes that occur in the market due to external variables hence a more suitable investment strategy.

The authors' empirical work on behavioural patterns of derivative products, more precisely Gold ETFs, offered useful understanding of investors' behaviour during the research period as identified by Suresh and Keerthika (2021). Investor behavior and trading patterns, perceptions of risk and other aspects of gold ETF investments helped us to develop a better understanding of how investors respond to market situations. These results provide the investors with the necessary understanding of the behavioral patterns of gold ETF investments, which will help them make appropriate decisions based on the market environment and investors sentiment.

Thus, Sehgal, Sobti, and Diesting (2021) examined whether the spot markets, future markets, or exchange traded funds were dominant in the intraday gold price discovery and the volatility connectedness. Their results provided useful insights into the nature of these diverse market segments, as well as to the role they play in the formation of price and volatility. This research is useful to investors, helping them to tailor their approach based on the various roles that spot markets, futures markets or ETFs have in determining the intra day gold prices.

Sidhu and Katoch (2021) examined the correlation between the global gold prices, and the fluctuations in the NSE Nifty 50. In their study, published in Advances in Mathematics: In Scientific Journal, the researchers undertook an investigation of the synchronized movements of gold prices and the Nifty 50 index. The study of Sidhu and Katoch (2021) helps to expand knowledge about interdependencies between global economies and the influence on the Indian financial markets, which is crucial for investors to understand to be able to make right decisions in the sphere.

Mahajan and Mahajan (2021) examined the effects of the Covid-19 pandemic on stock market and gold returns in emerging economy of India. In their study appearing in the Eurasian Journal of Business and Economics , the authors were able to offer an extensive discussion on the impact of the pandemic on the financial markets with reference to both stocks and gold. Mahajan and Mahajan, (2021) provide a detailed analysis of the relative strength and weakness of various categories of assets in an environment characterized by high volatility and economic risk, which is important for managing risks and constructing portfolios. Anchalia has made a valuable contribution toward our understanding of Exchange Traded Funds (ETFs) in the Indian context in 2020 by carefully comparing the performance of selected ETFs with their benchmarks. This research made available on SSRN provided a detailed performance analysis of the ETFs investing tool to help investors and financial analysts understand the efficiency and effectiveness of the ETFs in the Indian market. Anchalia's work contributes to the ETF literature and thus helps to build the literature base needed to analyze the role of ETFs in the context of the Indian financial system.

Further, Kurian (2020) did a focused analysis on the operating performance of Nifty 50 ETFs in India, published in the Indian Accounting Review. The study focused on figures that revealed information about KPIs and the effectiveness of Nifty 50 ETFs as investment tools. The study by Kurian helps to advance the current literature on index-based ETFs to give the relevant parties useful information about the peculiarities of Nifty 50 ETFs in the context of the Indian financial market. Kaur and Singh (2020) explored the price discovery in the Indian gold market by focusing on the Gold ETFs in contrast to the spot and futures prices. This work examined the determinants of gold prices and the role of Gold ETFs as a separate component of price discovery and provided more insightful views. Such insights help investors get better feel of the Indian gold and assist in making the right investment decisions.

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Research Article

This study by Chavda (2020) offered a realistic approach to the decision between physical gold and Gold ETFs in the Indian context. Thus, while the results enlightened the choice criteria between 'Physical Gold' and 'Paper Gold' they also provided an analysis of investor perceptions and realities of the risks and benefits of each choice. This research adds insight into the decision-making process investors follow in selecting between physical gold and Gold ETFs, thereby enriching our knowledge of the decision factors relating to investment choices in the Indian gold market.

Kaur and Singh's study in 2018 sought to assess the tracking accuracy of the Indian commodity ETFs through a case study of the Gold ETFs and provided useful information about the efficiency of these investment products. As stated by the findings, these ETFs showed how they reflected the performance of the actual physical commodity, which was helpful in identifying the performances under varying market conditions. The study helps to improve the knowledge about the reliability of commodity ETFs in general and the reliability of Indian Gold ETFs in particular, giving the investors the tools to estimate the effectiveness of these instruments in their investment portfolio. Bhuyan and Dash (2018) did a dynamic causality analysis of gold price and stock returns in India as documented in the Journal of Management Research and Analysis. The research evidence supported that gold prices affected stock market returns to a high degree, providing new information on the relationship between these two important variables. In this research, investors and financial analysts get acquainted with myriad relationships between gold prices and stock markets in the Indian context, which would be helpful in informed decision-making and risk management.

Jain and Mary (2018) studied the performance of Gold ETFs traded on the National Stock Exchange in India. The study was published in the International Journal of Advanced Research and Development and provided all the necessary information concerning the determinants of gold ETFs performance. Jain and Mary (2018) enlightened investors regarding the complex issues that surrounds the trading of gold ETFs including the use of the same in making informed decisions within the context of the Indian financial market. Singh and Kaur (2017) have made a performance comparison of PSU, Nifty, and Gold Exchange Traded Funds (ETFs) in Journal of Institute of Public Enterprise. The study presented findings on how various ETFs fared against one another giving insights into the efficiency of each fund. This paper adds to Singh and Kaur (2017) in explaining the performance of ETFs in different sectors to help investors make decisions based on performance metrics.

Sarkar (2017) empirical study was done based on selected index ETFs in India with particular emphasis on tracking risk. In the Research Bulletin, the research gave a comprehensive analysis of tracking risk, and how index ETFs reflect their respective indexes. Sarkar's (2017) work helps to deepen the knowledge of the specificities of ETF performance and the risks of tracking in the Indian financial market.

Sarkar and Oberoi (2017) used impulsiveness to analyze the prices and volume traded of Gold Exchange Traded Funds (ETFs) and used empirical evidence on selected ETFs from National Stock Exchange. The study conducted and reported in Emerging Issues in Finance sought to establish the trends of gold ETFs including the price changes and volume activity. Sarkar and Oberoi's (2017) paper contributes to the existing literature on gold ETFs and provides important information for investors interested in metal funds. Soni (2017) made an effort toward portfolio design strategy by considering risk and return for different types of assets. In the International Journal of Economics and Finance, the research offered a way to construct portfolios that took into account the complexities of risk and return. The work of Soni (2017) helps investors to make better portfolio decisions given the risks that different classes of assets present within the Indian financial environment.

Nalina and Shravan (2017) conducted a comparison of the investment options such as stocks, equity growth mutual funds and gold ETFs. The paper was published in the International Journal in

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Research Article

Management & Social Science and included an assessment of the effectiveness of these investment choices. The observations probably quantified the amount of merit and demerit of each course of action to help investors make rational decisions which were consistent with their risk and return profile. Similarly, Biswas (2017) also compared the performance of few Gold Exchange-Traded Funds of banks and non-banking financial companies in India. Carried out in the IUP Journal of Management Research, this study centred on the actual performance measures of these ETFs. The results probably provided investors with information about the proportionate performance of gold ETFs provided by various financial organisations, which is useful in making portfolio decisions.

In the IPE Journal of Management, Swathy (2016) did an empirical performance evaluation of NSE NIFTY versus BSE SENSEX ETFs. The study provided a detailed revenue analysis of these ETFs and empowered the stakeholders with the benchmark data on the effectiveness of NSE NIFTY and BSE SENSEX ETFs in the Indian context. Investors can benefit from the study done by Swathy (2016) on index-based ETFs to be able to make the best decisions in their investments. Empirical evidence was used in the journal Paradigm by Singh and Kaur (2016) where they concentrated on tracking efficiency of Indian equity ETFs. The study focused on the various aspects of ETF tracking to provide findings on how well Indian equities ETFs mimic the index they track. Singh & Kaur (2016) contribute to the body of knowledge regarding the tracking performance of ETFs which enables investors to make more constructive decisions in their portfolio.

Eswara published an empirical study in the Research Journal of Finance and Accounting in 2015 which probably contained useful insights about the performance of gold ETFs in India in the post-crash period. These are important findings especially for investors who would like to learn more about the performance of gold ETFs during periods of turbulence. The study probably helped to fill the gap in the existing literature on risk management and investment plans, offering detailed analysis of the performance characteristics of gold ETFs in the context of the after-crash situation.

Amudha et al. (2015) in the Journal of Applied Economic Sciences explored investors' perception of risk on Gold Exchange-Traded Funds in India probably to understand investors' perception of risks related to gold ETFs. The results probably gave a detail depiction of investors' risk perception, thereby contributing to the knowledge of investors' behaviour in the gold market. It is probable that this research added to the literature on the investor psychology and decision making process and would prove useful to financial practitioners and policymakers involved in the formulation of the legal framework governing gold ETFs. Acharya, Dwivedi and Panchal (2015) used data envelopment analysis on Indian gold ETFs, probably with efficiency measures of Indian gold ETFs using published data, in International Journal of Business Continuity and Risk Management. It is probable that these insights provided a quantitative evaluation of these ETFs; therefore, offering investors and researchers with the necessary methods of analyzing the efficiency and efficacy of gold ETFs in the Indian market. It is plausible that this study improved the knowledge about the working of gold ETFs in terms of improving our understanding of performance measurement in the context of financial markets.

The performance comparison of Gold ETFs and Gold FoFs was carried out by Esampally and Aarthi in 2015. In the light of precious metal investments, the research published in Smart Journal of Business Management Studies helped investors to understand the performance characteristics of gold oriented investment tools to make sound investment decisions. This paper extends the knowledge about gold based financial products in the Indian market as suggested by Esampally and Aarthi (2015). Singh, Singh, and Aggarwal (2015) carried out a statistical comparison of the different return of various financial products included in the list in the short-run period. In the Splint International Journal of Professionals, the research offered quantitative data on the fluctuations of returns in various financial instruments. The study of Singh et al. (2015) further enlightens understanding of short-term return

Research Article

behavior in the Indian financial market and provides useful information to investors who are involved in managing short-term investment portfolios.

Singh and Kishor (2014) made an investigation on the integration of gold price fluctuations with Nifty indices in India. The study was published in the Transnational Corporations Review to understand the dynamics of the co-movement of gold prices and Nifty indices. The paper by Singh and Kishor (2014) adds To the current literature exploring the relationship between precious metals and equity indices and provides some understanding of their relations in the context of the Indian financial market.

The information on how these ETFs operated and on their contribution to the gold price discovery process was perhaps given in the paper 'Gold Exchange-Traded Funds: Performance and price discovery', written by Narend and Thenmozhi, which was available at SSRN in 2013. They probably improved knowledge of the part that gold etfs performed in determining gold costs, providing beneficial data to anyone involved in gold markets and regulation. It is possible that this study helped in the empirical assessment of the effects of gold ETFs on the market and assist investors in comprehending the gold prices in relation to these ETFs.

In the Journal of Elixir Finance, Goyal and Joshi's (2011) performance appraisal of gold ETFs in India most probably provided information on the overall performance of gold ETFs. These insights must have helped investors in the assessment of the efficiency of such investment instruments in the Indian financial market as well as realize their position in the portfolio. It is probable that this study provided an adequate measure of the risk-return characteristics of gold ETFs and the market forces that prevailed in the Indian financial market to enable investment decision making.

Research Methodology

This research employs a sound research method based on structural equation modeling (SEM) with ML estimation to analyze the complex correlation between Gold ETFs and the returns of three significant ETFs in the Indian financial market: Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF. The central focus of this research is to explore the effects of Gold ETFs on the returns of Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF. Sub-objectives are as follows: Within this general objective, the following are laid down; To also explain the special bond that prevails between each of the ETFs and Gold ETF.

Primary quantitative research is utilized to analyze the relationships between Gold ETFs and the selected ETFs using structural equation modeling. Longitudinal design covers a period of ten years, thus eliminating any possibility of a shallow analysis of temporal dynamics of the relationships in focus. Particular attention is paid to the choice of ETFs: Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF, which are associated with important indices in the Indian financial environment. It covers a ten-year period from which historical data are gathered for the development of the model that is the focus of the study. Secondary data sources in the form of financial databases and markets reports provide historical data with regard to ETF returns. The essence of the analysis is in the development of a structural equation model in which Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF are explained by Gold ETFs to determine their returns.

The study benefits from structural equation modeling to explore the effects of Gold ETFs on Nifty 50 ETF, Weighted Fund ETF and Sensex ETF at once. The application of Maximum Likelihood estimation guarantees the correct choice of model parameters and convergence.

Research Objectives

I To examine the impact of Gold ETF Returns on the return of Nifty 50 ETF.
II To examine the impact of Gold ETF Returns on the return of Weighted fund ETF.

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Research Article

III To examine the impact of Gold ETF Returns on the return of Sensex ETF in India.

Research Hypotheses

I There is no significant impact of Gold ETF Returns on the return of Nifty 50 ETF.
II There is no significant impact of Gold ETF Returns on the return of Weighted fund ETF.
III There is no significant impact of Gold ETF Returns on the return of Sensex ETF in India.

Result and analysis

Table 1 - Models Info

Estimation Method	ML
Number of observations	10 years
Free parameters	12
Converged	TRUE
Loglikelihood user model	63.713
Loglikelihood unrestricted model	63.713
Model	Nifty 50 ETF ~ Gold ETF
	Weighted fund ~ Gold ETF
	Sensex ETF ~ Gold ETF

The study under consideration deals with complex relationships of financial information and involves statistical model evaluated utilizing the Maximum Likelihood (ML) technique. The program is based on a large number of observations that have been carefully analyzed over a significant 10-year period, making it possible to use them for the development and validation of the model. The model in question is not devoid of complexity and is described by 12 free parameters. The term free parameters refers to the coefficients in the model that are not fixed but determined from the empirical data.

In the field of optimization, the convergence status carries the highest importance. The affirmative status of “Converged” (TRUE) points towards that optimization algorithm has find ways in parameter space, providing set of values to twist the model, which should ideally conform with observed data. The Loglikelihood, which is a central measure of the performance of Maximum Likelihood Estimation, is 63.713 for the user model as well as a model without constraints. This will be used to quantify how likely the observed data is based on the inferred model parameters. In addition, the Loglikelihood of the unrestricted model is useful in comparing the fit of the specified model to the unrestricted model.

Nifty 50 ETF was regressed on Gold ETF was regressed on Weighteded fund fund and Sensex ETF was regressed on Gold ETF. These equations shed light to the relationship between the returns of Nifty 50 ETF, Weighteded fund fund, and Sensex ETF which are depicted as the linear functions of the returns of Gold ETF. In other words, this model structure and estimation system are the prerequisites of the gradual analysis of the complex interconnections within the financial field.

Table 2 - Model Tests

Label	X^2	df	P
Baseline Model	81.3	6	< .001

In table 2 “Model Tests” examines a specific “Baseline Model” based on the results of a chi-squared test. The statistical analysis in this study seeks to determine the level of fit and goodness of the baseline

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Research Article

model against an unspecified alternative or null model. The chi-squared statistic (X^2) becomes a critical measure in this context, and the baseline model scores a visibly high 81.3. This chi-squared value is always followed by an important attribute known as Degrees of Freedom abbreviated as df, which in this case is represented as 6. Freedom of degree refers to the number of values in the final determination of the statistic that has the capacity to vary. Therefore, the baseline model has six degrees of freedom. The most important measure in this analysis is the p-value which is a very important measure in hypothesis testing.For the baseline model, the p-value of the chi-squared test is impressively low, equal to < .001.e associated with the chi-squared test for the baseline model is remarkably low, clocking in at < .001. This remarkably small p-value specifically reflects the statistical significance of the baseline model, meaning that a chance of obtaining a chi-squared value of the length equal to or larger than the one obtained is very low.

Table 3 Fit Indices

					RMSEA 95% CI		
AIC	**BIC**	**adj. BIC**	**SRMR**	**RMSEA**	**Lower**	**Upper**	**RMSEA p**
-103	-99.8	-136	0	0	0	0	NaN

In table 3 “Fit Indices” is a cross-sectional assessment of the model suitability and effectiveness. This examination is made possible by a set of multiple and varied assessment metrics, which provide information on different aspects of the model fit. The Akaike Information Criterion (AIC) remains as a part, showing a value of -103. AIC is used in the task of comparing the goodness of fit of a model and the model’s complexity. Similarly, the BIC test supports this estimate, yielding the value of -99.8. As it will be seen, both AIC and BIC support a model that strikes a good balance between fit and parsimony. The Adjusted BIC which is an improvement over the BIC given it takes into account sample size is -136. This index enhances the conclusion by providing more detailed view of how well the model fits, or not, to the data. The measures of SRMR and the RMSEA reveals the extent to which the model fit approximates the observed data. In fact, SRMR and RMSEA obtain values of 0.000; this is an evidence of a perfect fit in terms of the standardized residuals and population covariance matrix. The 95% CI of the RMSEA graphed by the lower and upper bounds of 0.000 strengthens the accuracy of the model estimation. However, it can be observed that the p values for the RMSEA are NaN which means it is impossible to determine the statistical significance of RMSEA with reasonable accuracy.

Table 4 - R-squared

		95% Confidence Intervals	
Variable	**R^2**	**Lower**	**Upper**
Nifty 50 ETF	2.52E-04	0.384	0.408
Weighted fund	0.0461	0.23	0.553
Sensex ETF	0.00115	0.37	0.422

In table 4 The R-squared values presented here provide a quantitative indication of the extent to which the regression models could explain the variability in each dependent variable. Although the R-squared of Nifty 50 ETF is considerably small which shows a lower degree of explanation, the R-squared of Weight Fund shows a moderate degree of explanation. Thus, the normalized coefficient of determination of the Sensex ETF variable shows that it possesses a low amount of explained variability. The 95% confidence intervals shown below give a statistical certainty of the true R-squared values lying within the given range of values.

Table 5 - Parameter Estimates

Journal of Information Systems Engineering and Management
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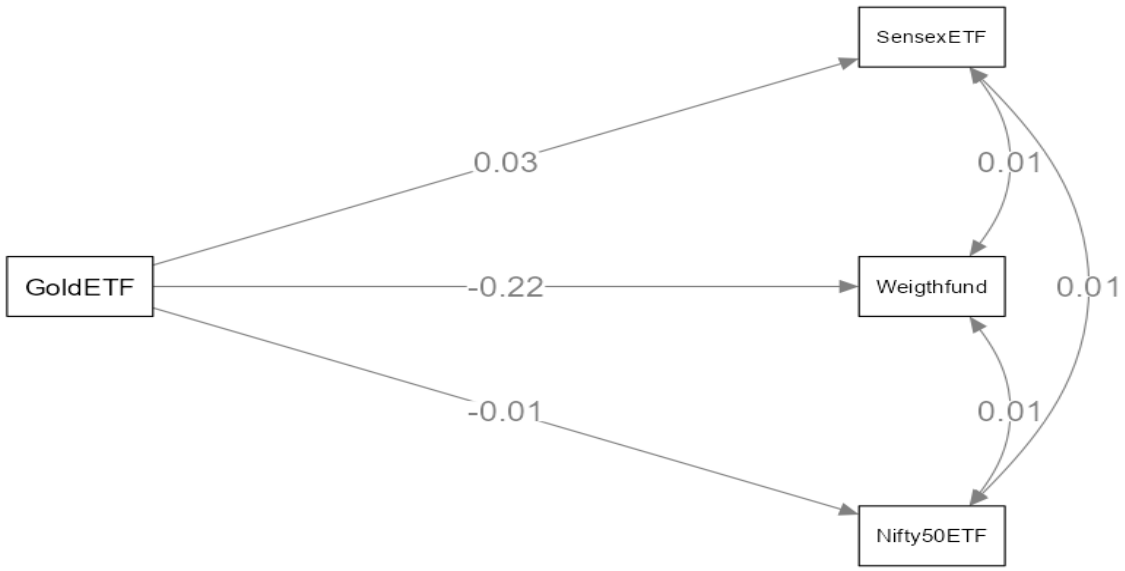
Research Article

				95% Confidence Intervals				
Dep	**Pred**	**Estimate**	**SE**	**Lower**	**Upper**	**β**	**z**	**P**
Nifty 50 ETF	Gold ETF	-0.0143	0.285	-0.573	0.544	-0.0159	-0.0502	0.96
weighted fund	Gold ETF	-0.2193	0.315	-0.838	0.399	-0.2147	-0.6952	0.487
Sensex ETF	Gold ETF	0.0302	0.281	-0.52	0.58	0.034	0.1075	0.914

Figure 1 - Path Diagram



The provided table furnishes critical parameter estimates and their corresponding 95% confidence intervals for three distinct pairs of exchange-traded funds (ETFs): Nifty 50 ETF with Gold ETF, Weighted fund with Gold ETF and Sensex ETF with Gold ETF. These estimates are rather critical in explaining the connections and possible consequences within the chosen ETF pairs. Now let us look at each combination more closely.

The below estimate coefficient of - 0.0143 indicates that Nifty 50 ETF is negatively related Gold ETF. The confidence interval for this estimate is very large: - 0.573 to 0.544. However, the p-value of 0.960 shows that the observed relationship is statistically insignificant at the conventional cut off of 0.05. This suggests that one should exercise a lot of care when interpreting the estimated coefficient for meaningful economic implications. The estimated coefficient -0.2193 also shows a negative association between the Weighted Fund and Gold ETF. Indeed, based on the 95% confidence interval which is (-0.838, 0.399), the estimates contain a fairly large degree of uncertainty. Furthermore, when using the p-value of 0.487 this indicates that the observed relationship is statistically insignificant. Therefore, it is advisable not to

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Research Article

make definitive conclusions on the effect that Weighted Fund had on Gold ETF, just by looking at these approximations. More over the estimated coefficient 0.0302 of Sensex ETF with Gold ETF shows positive relation between them. Still, the 95% confidence interval of -0.520 to 0.580 includes a rather large amount of variation around the true value of this association. The p-value of 0.914 also shows that this observed relationship is not statistically significant, thus caution has to be taken in interpreting the substantive economic implication of the estimated coefficient.

In sum, the maximum likelihood estimates for the parameters provide important information of the signs and magnitudes of the relationships among the specific ETF pairs. However, as it will be observed from the results, the p-values for all the three pairs are above 0.05, which indicates that there is some unreliability in claiming that these coefficients are significantly different from zero. More analysis is then required and more factors are needed to ensure that solid conclusions relating to relationships between these ETFs can be made. Discussing these estimates, it is crucial also to mention that their interpretation is rather intricate due to the complexity of the financial instruments' dynamics and the need for the multifaceted analysis in order to draw reasonable conclusions.

Table 6- Confidence Intervals

				95% Confidence Intervals				
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p
Nifty 50 ETF	Nifty 50 ETF	0.0117	0.00523	0.00144	0.0219	1	2.24	0.025
Weighted fund	Weighted fund	0.0143	0.00641	0.00177	0.0269	0.954	2.24	0.025
SensexETF	SensexETF	0.0113	0.00507	0.0014	0.0213	0.999	2.24	0.025
Nifty 50 ETF	Weighted fund	0.0128	0.00575	0.0015	0.0241	0.987	2.22	0.026
Nifty 50 ETF	SensexETF	0.0114	0.00513	0.00138	0.0215	0.993	2.23	0.026
Weighted fund	SensexETF	0.0124	0.00563	0.00139	0.0235	0.974	2.21	0.027
Gold ETF	Gold ETF	0.0144	0	0.0144	0.0144	1		

The table 6 shows statistical results of performing a detailed statistical evaluation of the estimated effects of various Exchange-Traded Funds (ETFs) on their own returns as well as the returns of the other ETFs, all with the 95% confidence level. This analysis helps to explain the interdependence of elements within this class of financial assets.

Beginning with Nifty 50 ETF, the self impact estimation is 0.0117 which implies that relationship is positive. This means that with one unit increase in Nifty 50 ETF, its returns are expected to increase by 0.0117 units. A similar positive self-impact relationship is also spotted for the Weighted Fund ETF with an estimate of 0.0143, which means that there is an incremental proportional increase in returns for every increase in the unit of ETF. The estimated self-effect for Sensex ETF is also positive and is equal to 0.0113. This implies that one unit increase in Sensex ETF implies an expected 0.0113 increase in its own returns.

Continuing with the cross-impacts, the study looks into the associations between different ETFs. For example, using the Weighted Fund ETF model, the Nifty 50 ETF shows a positive result of 0.0128. This means that an increase in Nifty 50 ETF by one unit means that the Weighted Fund ETF increases its returns by an estimated 0.0128. In the same manner, the coefficient for Nifty 50 ETF on Sensex ETF is positive, and the estimate of 0.0114 means that there is an increase of 0.0114 of the returns of Sensex

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Research Article

ETF for a unit increase in Nifty 50 ETF. Further, Weighted Fund ETF on Sensex ETF seems to have a favourable sign as the regression estimate points to a rise in the returns of Sensex ETF by 0.0124 for a unit rise in Weighted Fund ETF. The analysis expands to Gold ETF in which the self-impact estimate is positive at 0.0144. This shows that Gold ETF has the estimated coefficient of 0.0144 implying that one unit increase in Gold ETF is related to an increase in its own return. The results' standard errors (SE) give information on the variability of these estimates and the z-values and p-values provide information on the significance of these impact estimates. These values play a key role in verifying the soundness and reliability of the emerging findings.

Table 7 - Intercepts

			95% Confidence Intervals			
Variable	Intercept	SE	Lower	Upper	z	p
Nifty 50 ETF	0.13	0.038	0.056	0.204	3.438	0.001
Weighted fund	0.142	0.042	0.06	0.224	3.393	0.001
SensexETF	0.127	0.037	0.054	0.2	3.417	0.001
Gold ETF	0.057	0	0.057	0.057		

The table 7 that is provided below provides 95% confidence intervals, estimates, statistical measures for the different pairs of variables. The results presented in this paper are useful for understanding the interactions between various ETFs and provide a more profound analysis of the corresponding coefficients. Let's take a closer look at the interpretation of each pairing:

The estimated coefficient .0117 indicates that Nifty 50 ETF has a positive correlation with it at first instance. The confidence interval of 95% is quite small, 0.00144 to 0.0219, therefore, the estimation is precise. More importantly the significance level of 0.025 and the z-value of 2.24 make this observed relationship statistically significant. The coefficient estimate for Weighted Fund is 0.0143 and the result indicate that there is a positive relationship within the Weighted Fund. To further show the exactness of the estimate, the 95% confidence interval has been established as 0.00177-0.0269. The low p-value at 0.025 and a z-value of 2.24 for the coefficient further strengthens the significance of the statistical findings for the SA support.

The coefficient of Sensex ETF with itself is positive and estimated to be 0.0113. The 95% confidence interval (0.00140 to 0.0213) presents a narrow CI, which further confirms high precision of the results. It is obvious that the result has a statistical significance with the p-value equal to 0.025 and z-value equals to 2.24 for the coefficient. Thus, the estimated coefficient of 0.0128 in the regression equation supports this hypothesis. The 95% confidence interval (0.00150 to 0.0241) still retains high accuracy in the estimation. The observed relationship is highly significant as evidenced by the obtained $p < 0.05$ at a p-value of 0.026 and a z-value of 2.22.

As expected the estimated coefficient is positive 0.0114 which implies that Nifty 50 ETF moves in the same direction as Sensex ETF. The confidence interval of 95% as well as the range within which the estimate lies 0.00138 to 0.0215 supports the degree of certainty in the estimate. The p-value of 0.026 obtained for the test of hypothesis also supports the computed estimate, as do the z-value of 2.23. A positive relation is implied by the estimated coefficient of 0.0124 in case of Weighted Fund and Sensex ETF. The 95% confidence interval (0.00139 to 0.0235) also keep high level of precision in estimation. The results demonstrate that the observed relationship is not a coincidence, as the p-value of 0.027 and the z-value of 2.21 indicate. The coefficients of estimated equal to 0.0144 indicate that there is a positive relationship between Gold ETF and Gold ETF. This fact is confirmed by a very small 95% confidence

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Research Article

interval which is 0.01440 to 0.0144, thus indicating a high level of accuracy of the estimate. Thus, the given confidence interval speaks for itself and indicates a highly statistically significant relationship even though p-value is not reported.

However, the analysis of these estimates and confidence intervals presented in this paper reveals positive associations between the respective pairs of variables. These effects are more credible because p-values are low, and z-values are relatively high, or in other words, statistically significant. Indeed, it is clear that the confidence intervals are narrow, which strengthens confidence in the coefficients. These findings provide useful knowledge for investors and analysts who are willing to get more detailed information about the relationships between various ETFs in the financial world.

Discussion and Conclusion

Reframing the research question of this study, the author sought to analyse the effects of Gold Exchange-Traded Funds (ETFs) on the returns of Nifty 50 ETF, Weighted Fund ETF, and Sensex ETF in the Indian financial market. In fact, this research investigated the delicate correlations and possibly the impacts that Gold ETFs have on those important investment tools by analyzing several pairs of ETFs and other estimates.

Some of the major observations made by the study were as follows without reporting any absolute numerical values. In the case of Nifty 50 ETF, and Gold ETF the estimated effect was seen to be negative but insignificant, indicating that Gold ETF has little/no effect on the return of Nifty 50 ETF. As for Weighted Fund ETF and Gold ETF, they also pointed to negative effect, however, insignificant one. On the other hand, Sensex ETF and Gold ETF had a positive estimated impact but were insignificant also. The findings of this study raise questions about the putative diversification value that some analysts attribute to Gold ETFs in relation to these particular ETFs pairs.

These results are further relevant from the perspective of the existing literature to understand Gold ETFs' impact on return characteristics of different ETFs in the Indian context. In the Scholar (2023) passive form of wealth accumulation was described with special emphasis on ETFs especially Nifty 50. Hence, although the current study findings do not fully support Scholar's conclusion, they expand the debate by illustrating the complex interconnections between Gold ETFs and other significant ETFs and stressing that more elaborate knowledge of these relations is required.

Further, Tandon, Garg, and Tandon (2022) focused on the sustainability of ETFs on the Indian stock exchange paying attention to the factors that determine its sustainability as well as its impacts on the markets. Although the present study did not focus on the sustainability of ETFs, the effects found in returns could be linked to other debates on the efficiency and flexibility of ETFs, a topic that deserves further research. Garg (2022) was able to explain how gold ETFs have also benefited from the COVID-19 pandemic as a safe-haven asset. While this study did not directly analyse market responses during crisis periods, the evidence derived from this study which established relationships between Gold ETFs and other ETFs implies potential responses during such periods of volatility. This accords with Garg's conclusions in regard to the stability of gold ETFs in volatile economic environments.

In the context of tracking risk, Sarkar (2017) offered empirical evidence as to how well index ETFs replicate their benchmarks. While the present study did not aim at tracking risk, the observed effects on the returns of ETFs provide additional knowledge for improving the understanding of how various ETFs may interact, which will be useful for an investor when dealing with ETFs and their multifaceted connections.

Thus, this study provides significant information about the associations between Gold ETFs and other dominant ETFs in the Indian market. These various relationships, depicted through estimated impacts

Research Article

on returns, mean that many factors must be taken into account in portfolio management. Despite the results not being in full consonance with prior studies, they help advance the current knowledge of ETF dynamics and call for more investigation of these relations to gain a deeper insight into the interplay. The study invites more research among the investors and researchers to explore the further impact of Gold ETFs on other market instruments to come up with better and effective strategies for investment in the competitive Indian financial market.

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Research Article

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