

## LONG RUN TRACKING ERROR AND PRICE DISCOVERY OF EXCHANGE TRADED FUND'S ON GOLD

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### **Abstract**

*The study intends to analyse whether the ETFs have an influence on the price discovery of gold. Future market had played a dominant role in the price discovery of underlying assets. The analysis of price discovery brings knowledge about the market where most effectively prices are incorporated with the fundamental information and also focuses on market performance because it is a measure of the ability of the market to process information. Here the study examined that prices of gold and ETF prices are closely related, that means ETFs are closely following the underlying asset of gold. We found that ETFs are tracking their underlying asset of Gold in India. From the Augmented Dickey Fuller Unit Root Test and Johansen Co- integration tests it is revealed that among the two variables -price of gold and price of gold ETFs, there exist a long run relationship. Moreover, study talks about the granger causality exist between Gold ETFs and MCX spot price of the gold. There we found three ETFs are having bi-directional causality and the rest are following uni-directional causality.*

**Key words:** Gold ETF, Price Discovery, Spot Price, Tracking Error, Pricing Deviation

### **1. Introduction**

Exchange traded funds (ETFs) are a remarkable example of financial innovation that facilitate the investors with distinctive features of mutual fund and an ordinary stock. ETF act as the stock because it can be traded in the stock exchange, and at the same time act as mutual funds because they are providing diversified portfolio. An exchange traded funds possess a portfolio, at the same time it can be traded in the stock market. Valle & Beasley (2014) observed that ETF prices vary according the changes in price of underlying portfolio of assets vary in value,).

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The benefits of ETFs over mutual funds are, among other things, lower costs, the possibility of tracking the performance of the whole market rather than investing in single stocks, and potentially better investment results, as active fund managers tend to underperform the market. ETFs have brought fundamental changes to the construction of portfolio, due to their ease of diversification.

Here the study focuses on gold ETF and its price discovery factors. Gold is considered as a safe haven investment. Gold has a major role in investment avenues because of its ability to provide liquidity and transparency in price discovery. Gold is considered as the ideal medium of exchange because of its acceptability, durability, portability etc. And moreover gold belongs to a commodity also. Gold bullion securities was the first gold ETF, it was launched in Australian securities exchanges in the year of 2003. 23% of the global demand for gold is consumed by Indians. Their investment in the yellow metal is huge comparing to the rest of the world. So the first gold ETF launched by UTI (Unit Trust of India) was a great milestone for the Indian economy. By launching gold ETF UTI opened a new door to attract more investment in the gold. Gold exchange traded funds have revolutionised the gold market in the present scenario. Bang (2009) defined Gold ETF as the open ended Mutual Fund where fund is raised through standard gold bullion. By investing Gold ETFs investors can track the price of the gold rather than putting the money just as an investment. Instead of that they can achieve gains through watching the variation in the price. Price discovery is a function of fixing the price through the analysis of demand and supply factors which are highly influencing the price of a commodity or a security. Apart from trading mechanism financial markets facilitate price discovery, i.e, influencing new information into the formation of price to a security, Hasbrouck, (1995). Price discovery is related with how the information is produced and transmitted across market. Information is about market structure including number, location, and competitiveness of buyers and sellers is influencing the price discovery. Ivanov Jones & Zaima (2013) advocated that ETF brought a significant role in the price discovery for the gold, and ETF has shifted the price discovery of the gold to the ETF market from the dominating role of future market.

The study mainly deals with how Indian gold ETF is related with MCX spot price of the gold. And moreover analysing the causality exist in such relationship among them. In, India gold ETF have made a fast growth and investors have showed interest to prefer gold ETFs. Due to numerous advantages of ETFs over the traditional mutual funds, the growth rate of ETFs becomes prominent

### **Literature survey**

Exchange Traded Funds have become gradually more popular among investors in the last Decade. Due to their abundant advantages, ETFs have lured the retail and institutional Investors alike. ETFs are traded daily like stocks on the stock exchanges and they closely track the real time underlying NAVs. The extraordinary progress of ETFs, has created the concentration of researchers and investors. There lot of studies about ETF in the developed markets of U.S and U.S. Here the study focuses on how ETF is influencing the gold price in Indian market. Narend&Thenmozhi(2013)found that a bi-directional causality exist between MCX spot price of the gold and Indian listed Gold ETF. And the case of U.S is different, there exists Uni -directional causality between Gold spot price and U.S listed Gold ETFs.

The study defines the tracking errors as the degree in which ,the performance of benchmark and fund returns are associated ,in other words it focuses on how well the Gold ETF s track the benchmark ,i.e. ,real time gold price.S.Shin&G.Sodymer (2010) observed that, the statistically significant alpha determines the relative performance of ETFs reveals the evidence of existing tracking errors. Harper et al highlights the comparison of risk and return performance of foreign market ETFs and closed country funds.K.Bansal&F.Marshall(2015)observes the tracking error decomposition and return attribution in leveraged ETFs, They found that trend, volatility, financing and management of components return for leveraged exchange traded funds will create a rise in tracking error.Mahmod& Joseph (2012) revealed about linkage between volatility and tracking errors, the study reveals tracking error is positively correlated with the daily volatility of the ETFs, and during the time of trading, volume has less effect on reducing tracking error.

Exchange traded funds are functioning just like a stock means the investors can freely purchase and sell. ETFs throughout the market hours and the price is determined by demand and supply factors.The working mechanism of price discovery in the future market is based on the observation of linkages between price changes happening in both the markets of cash market and future market. In general future market dominates cash market. (Kenneth D. Garbade and William L. Silber, 1983, Koch, Stoll and Whaley (1990); and Koch (1987); Chan (1992); and Whaley (1996); Booth et al. (1999) Fleming, Ostdiek, Chu et al.(1999) studies about how much is the flow of information

among different markets such as spot markets, future markets, and options market. Moreover checking whether, there exist a lead – lag relationship because of the flow of information and how it influences the process of price discovery. The price of underlying asset and ETF price are keeping a long term relationship and they are following a Uni-directional causality from the Net Asset Value of underlying price to the ETF price. Another remarks from this article is, during the second half of 2007 ETF was not following the Net Asset Value of the underlying asset as a result of the huge volatility occurred in the Chinese Market. Bernstein (2009) has opined that important changes have occurred in the underlying asset because of the influence of ETF. Gerasimos (2011) observed that every moment in ETF can be assumed and return dominance is constant for the short term point Pavabutr and Chaihetphon (2010) studied about the price discovery and liquidity in the future market, according to them, price discovery happened in the future market because future price leads the spot price. They also found that the key sources of price discovery and liquidity are standard gold future contract in the MCX market. This study focus on how ETF influences the price of the gold in Indian context.

Gold ETFs have defined by many researchers in many ways. Bang (2009) observed gold ETF as the fundamentally open-ended mutual fund that invests in standard gold bullion as its underlying asset. It can be treated as paper gold also. Gold ETF Index Fund is a type of gold-based assets. Prasanna (2012) studied about the development of ETFs, where she found that that gold provides returns in excess of 13% as compared to the returns offered by the equity market. DeFusco and Ivanov,(2011) found that ETFs may also serve as a price discovery vehicle for spot prices. Timothy, Ehsani &Lien (2014) found that ETFs are playing a major role in volatility generating process to their underlying assets,i.e. to the largest component stock. Our study focuses on how the trading of ETF brings the attention to the discovery of gold price.

The intention of this study is to understand the dynamics of gold ETFs and spot prices of gold and also to examine the interlink ages between the returns and differences in prices of spot prices of gold and gold ETFs. The study tries to observe pricing deviations of gold ETF in connection with their underlying spot prices of gold. And also examines whether there is a long run relationship between gold ETFs and spot gold price. It is an attempt to understand the casual relationship between ETFs and spot price of the gold.

## **Data and methodology**

Here in the study we have considered 10 gold ETFs traded in the BSE. For analysis we have taken the daily closing price of Indian listed gold ETFs namely BIRLA SUNLIFE GOLD ETF, GOLDMAN SACHS GOLD ETF, HDFC GOLD ETF, ICICI PRUDENTIAL GOLD ETF, KOTAK GOLD ETF, QUANTUM GOLD ETF, RELIANCE GOLD ETF, SBI GOLD ETF, MOTILALA OSUAL MOST SHARES, AND CANARA ROBESCO MUTUAL FUND GOLD ETF. The data have been taken for ETF and gold are from BSE and MCX respectively. The time period considered for the study is fixed as per the availability of each Gold ETF data. Here the comparison made for each ETF with the spot price. So the time period chosen for each ETF is varied. Since the data used for the analysis is time series data, the stationarity of the data is examined using Augmented Dickey Fuller tests. To know how well ETFs are tracking their underlying asset, i.e., gold, we use the simplest definition of Tracking Error which is just the difference between the return on the gold and the return of the ETF. Thus, the TE of gold is defined as the difference between the return of the gold in the spot market and the return of the ETF. A one sample “t” test was also conducted to check the significance of the means. The Pricing Deviation is measured as the difference between the log of spot prices of gold and the log of ETF prices. We applied Johansen co integration test to know the co integrating or long run relationship among spot price of the gold and ETF. Co integration indicates that causality exists between the two series, but it fails to show the direction of the casual relationship. In this study we are just seeing whether a long run relationship exist or not among Gold spot price and Gold ETF price.

## Analysis and interpretation

**Table 1 Descriptive statistics for MCX spot gold prices and gold ETFs listed in India.**

|                  | N    | MEAN     | S.D  | MIN      | MAX   | SKEWNESS | KURTOSIS |
|------------------|------|----------|------|----------|-------|----------|----------|
| GOLDBEES         |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1617 | 2465.3   | 371  | 1577     | 3083  | -.742    | -.416    |
| <i>GOLD SPOT</i> | 1617 | 26137.91 | 4235 | 16055    | 32943 | -.891    | .176     |
| HDFC             |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1460 | 2753.2   | 306  | 1853     | 3217  | -.654    | -.227    |
| <i>GOLD SPOT</i> | 1460 | 27072.14 | 3284 | 18650    | 32943 | -.936    | .136     |
| BIRLA            |      |          |      |          |       |          |          |
| <i>ETF</i>       | 935  | 2619.75  | 221  | 2177     | 3199  | -.345    | -.497    |
| <i>GOLD SPOT</i> | 935  | 28211.29 | 2188 | 21600    | 32943 | -.513    | .176     |
| CMF              |      |          |      |          |       |          |          |
| <i>ETF</i>       | 427  | 2757.41  | 239  | 2365     | 3395  | .546     | -.640    |
| <i>GOLD SPOT</i> | 427  | 27683.72 | 4094 | .0000001 | 32943 | -4.98    | 31.95    |
| ICICI            |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1245 | 2580.04  | 471  | 276      | 3200  | -3.019   | 11.99    |
| <i>GOLD SPOT</i> | 1245 | 27247.20 | 3284 | .0000001 | 32943 | -2.670   | 14.184   |
| KOTAK            |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1618 | 2021.79  | 951  | 223      | 3081  | -1.041   | -.407    |
| <i>GOLD SPOT</i> | 1618 | 26133.07 | 4239 | 16055    | 32943 | .889     | -.338    |
| MGOLD            |      |          |      |          |       |          |          |
| <i>ETF</i>       | 672  | 2850.82  | 200  | 2420     | 3248  | -.241    | -1.029   |
| <i>GOLD SPOT</i> | 672  | 28685    | 3409 | .0000001 | 32943 | -6.183   | 49.862   |
| QGOLDHALF        |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1616 | 1233.57  | 187  | 785      | 1555  | -.787    | -.373    |
| <i>GOLD SPOT</i> | 1616 | 26138.91 | 4236 | 16055    | 32943 | .891     | -.331    |
| RELGOLD          |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1617 | 2395.41  | 362  | 1534     | 2989  | -.787    | -.373    |
| <i>GOLD SPOT</i> | 1617 | 26137.77 | 4235 | 16055    | 32943 | -.891    | -.331    |
| SBIGOLD          |      |          |      |          |       |          |          |
| <i>ETF</i>       | 1618 | 2519.19  | 383  | 1610     | 3163  | -.744    | -.409    |
| <i>GOLD SPOT</i> | 1618 | 26141.36 | 4236 | 16055    | 32943 | -.891    | -.331    |

The unit of pricing for spot prices of gold is taken as per the 10 gm of gold. Here the descriptive table shows that central moments of tendency for all listed gold ETFs and MCX spot price of the gold. Being time series data the commodity spot prices of Gold and ETF prices exhibited non stationary. The variables invariably are not stationary at zero level differences but are stationary at first level differences.

### Tracking error and pricing deviation of gold ETF

Tracking error checks whether ETFs are trying to deliver the same returns as per the underlying assets. Tracking difference is the discrepancy between ETF performance and the performance of underlying assets. The study tries to understand how well the gold ETFs are tracking their underlying asset of gold. It can be calculated by the following equation.

$$TE = \sqrt{\sum_{i=1}^n \frac{(R_p - R_B)^2}{N - 1}}$$

Where, TE= Tracking Error

R<sub>p</sub>= Return of fund

R<sub>B</sub>= Return of index (underlying)

N= No. Of return periods

The result of tracking error is given in below given table,

|             | N    | Mean      | Std. Deviation | P value | Std. Error Mean |
|-------------|------|-----------|----------------|---------|-----------------|
| TEGOLDBEES  | 1623 | .00342942 | .131615981     | .294    | .003267002      |
| TEHDFCGETF  | 1466 | .00123469 | .043315172     | .275    | .001131288      |
| TEBRLAGETF  | 941  | .00057739 | .022881525     | .439    | .000745916      |
| TECRMFGETF  | 426  | .02097795 | .447605369     | .334    | .021686551      |
| TEICICIGETF | 1244 | .58493802 | 19.943339423   | .301    | .565441514      |
| TEKOTAKGETF | 1623 | .02330445 | .891841070     | .293    | .022137481      |
| TEMGOLDETF  | 671  | .00298085 | .083820430     | .357    | .003235852      |
| TEQGOLD     | 1622 | .00235560 | .087753893     | .280    | .002178918      |
| TERELGETF   | 1623 | .00229626 | .091229877     | .311    | .002264529      |
| TESBIGETF   | 1623 | .00017966 | .007577863     | .340    | .000188099      |

Low tracking error indicates ETF is closely following the underlying assets results

shows that tracking error exists among Indian gold ETFs Considered for the study. Since the tracking error results are minimum .the inference is that gold ETFs track their underlying asset prices closely. For the low tracking errors risk and return will be minimum. So from the result except ICICI other ETFs have low tracking error, so those funds are considered to be passive managed funds. Active managed fund will be having higher tracking error and also risk and return will be high. So here tracking error of ICICI is higher by comparing to others.

### Pricing deviation

Another aspect of ETF we are seeing by considering pricing deviation (PD), it can be calculated by taking the difference between the log price of benchmark and log price of fund. Here pricing deviation is the difference between log price of MCX gold and log price of Gold ETF.

| <b>Table 3 Pricing deviation - One-Sample Statistics</b> |          |             |                       |                |                        |
|--|----------|-------------|-----------------------|----------------|------------------------|
|  | <b>N</b> | <b>Mean</b> | <b>Std. Deviation</b> | <b>P value</b> | <b>Std. Error Mean</b> |
| PDBIRLAGETF  | 9        | .00069373   | .01809834             | .2             | .000589989             |
| PDCRMFGETF   | 4        | .02180658   | .44832377             | .3             | .021721358             |
| PDGOLDBEES   | 9        | .00002862   | .00167427             | .6             | .000054580             |
| PDHDFC   | 9        | .00001893   | .00275516             | .8             | .000089816             |
| PDICICI  | 9        | .00002401   | .00644164             | .9             | .000209992             |
| PDKOTAK  | 9        | .00003040   | .00218856             | .6             | .000071345             |
| PDMGOLDETF   | 6        | .00292833   | .08163573             | .3             | .003151512             |
| PDQGOLDHLF   | 9        | .00002789   | .00225896             | .7             | .000073640             |
| PDRELGETF  | 9        | .00002970   | .00226247             | .6             | .000073755             |
| PDSBIGETF  | 9        | .00003152   | .00246219             | .6             | .000080265             |



Pricing deviations reveals how the price and return based on the underlying asset prices are deviated from the ETF prices. Pricing deviations are not significant for the selected Indian gold ETFs, therefore it can be assumed that there is no pricing deviations for gold ETFs.

## Cointegration

There are numerous studies examining the price discovery process of commodities. But most of the studies were mainly concentrated on futures market only. Here it's an attempt to bring the role ETFs in the process of price discovery. (Ivanov, 2011) examines the role of gold ETFs in the price discovery process. Here we employed Johansen Co-integration tests to check the long run relationship between MCX gold price and ten selected Gold ETFs traded in the BSE.

**Table 4 Johansen Cointegration result**

|           | GOLD             |                |
|-----------|------------------|----------------|
| GOLD ETFs | Trace statistics | Critical value |
| IIDFCGETF | 147.5201         | 3.841466       |
| BIRLAGETF | 151.1984         | 3.841466       |
| CRMFGETF  | 79.75300         | 3.841466       |
| GOLDBEES  | 158.5861         | 3.841466       |
| ICICIGETF | 143.6485         | 3.841466       |
| KOTAKGETF | 159.5401         | 3.841466       |
| MGOLDETF  | 77.84053         | 3.841466       |
| QGETF     | 158.5612         | 3.841466       |
| RELGOLD   | 162.6875         | 3.841466       |
| SBIGETF   | 161.3385         | 3.841466       |

Co integration talk about the long run relationship and causality exist in two series. From The result of co integration shown in the above table it's clear that every selected GOLD ETFs having a long run relationship with the underlying asset of gold. As per the co integration test null hypothesis will be the assumption of no cointegrating vectors. This is determined by looking the values of trace statistics and critical value. For every gold ETFs trace statistics value is more than the critical value, in that case we can reject the null hypothesis of no co integrating vectors. Thus there is a long run relationship among gold and gold ETFs selected for the study.

### **Granger causality**

Co integration indicates the causality exist between two series, but it fails to show the direction of causal relationship. Engel and Granger suggest that if cointegration exist between variables in the long run there must be uni-directional or bi-directional granger causality between variables.

Our objective is to check whether there exist causality between two variables, MCX Gold spot price and Gold ETF price. The null hypothesis is variables do not granger causes. The result reveals that, among ten selected gold Indian Gold ETFs, three ETFs (BIRLAGETF, MGOLDETF & HDFCGETF) shows bi directional granger causality. That means gold pot price granger causes ETF price, and vice versa. It is meaning that past values of both Gold spot price and Gold ETF price will help to predict each other. And the remaining seven ETFs are showing uni-directional causality; here their uni - direction is from gold price to ETF price. That means granger causality runs one way from Gold price to ETF price. So it can be assumed that past values of MCX gold price will contain information that helps to predict Gold ETF price than the information contained in past value of Gold ETF alone. MCX Spot gold price is influencing Gold ETF price these seven Indian Gold ETFs

### **Conclusion**

The study examines the relationship between Gold and Gold ETF. Here we saw how well the gold ETFs track their underlying asset of gold. We understood the tracking efficiency through pricing deviation and tracking error method. The study finds that Gold ETF tracking the Gold very closely. Tracking error and pricing deviations found to be insignificant. From the Pricing Devaiton observed through the study we can assume that The ETFs prices are quoting higher than that of the spot price of the Gold. By seeing the pricing deviation it is clear that the proportions of the underlying assets in ETF are effectively managed. From the result of Co integration it's clear that Gold and Gold ETF selected for the study posses a long run relationship. Granger causality shows for some ETFs there exist bi-directional causality and for the rest there exist a uni-directional causality. Thus the price of the ETFs will be highly influenced by the Gold. so the inference of the study is underlying asset and Gold ETFs are closely related or they are influencing each other.

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