

Descriptive Analytics during Disruptive Periods of Investments – A Case Study on Gold & Gold ETFs

P. Baba Gnanakumar

School of Management, Kristu Jayanti College, Bangalore -77, India

Article Info

Volume 83

Page Number: 2650 - 2655

Publication Issue:

March - April 2020

Abstract:

Gold ETF, which has been introduced in 2007, in the Indian market as an alternative to investment in physical gold witnessed a heavy outflow of investment during the period 2017-18; whereas, investment in Gold has increased. This research aims to find out the reason for this phenomenon and to create investment analytics between Gold and Gold ETF. We apply K-means of clustering for identifying the bullish/bearish trend in returns and ROC analysis to diagnose the goodness of predictability. The investment analytics is based on short-term gains during the sporadic trends. We found that the decrease in Gold ETF investments is due to less intra-day returns in Gold ETF as compared with Gold. We conclude that the returns from Gold ETF and physical Gold will have an equilibrium effect during the bullish period only. The bearish trend in Gold ETF may be hedged through Gold but not vice-versa. The reason for the negative effect has been portrayed in the ROC curve. During bearish trend, the mutual fund organisations of Gold ETFs are unable to market the product; where as in case of physical Gold, investors are not having negative perception. However, during bullish trend, the investment in both physical Gold and Gold ETFs are yielding same returns. This research enables the mutual fund managers to decide the investment analytics among Gold ETFs.

Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 20 March 2020

Keywords: Gold ETF, Descriptive Analytics, ROC, Investment analytics.

I. INTRODUCTION

Gold Exchange Traded Fund (ETF) is introduced in the Indian market with the aim of investing in Gold by the Indian Mutual Fund firms since 2007. The prices of Gold ETF and physical Gold moves in a similar direction. However, during the period 2017-18, Gold ETF in India witnessed a negative trend among the investors. However, the investment in physical Gold increased by 28% (WGC,2018). Around Rs 835 crores were pulled out the Gold ETF by the investors in the financial year 2017-18 (AMFI, 2018). In this context, the present study is motivated with the aim of identifying the reasons beyond the price differentials and to create analytics to predict the investment pattern between the investment in Gold ETF and physical Gold.

II. KNOWLEDGE GAP

The research done by Nargunam (2017) proved that the efficient market hypothesis does not hold for the gold exchange-traded funds' market in India. Arvind's

research on the pricing of Gold ETF proved that the Gold ETFs are over-priced (Aravind, 2015). A comparative study conducted on the efficacy of five gold exchange-traded funds (ETFs) vis-a-vis four index ETFs during 2009 to 2013 proved that index funds are performing better in comparison to gold funds (Acharya,2015). Comparative research done in Gold and Gold ETF proved that the performance of the physical gold is better than the performance of gold ETFs (Sunkara, 2017). Jain's research on Gold ETF found that the ETFs are positively correlated to spot Gold Price, and it is negatively correlated to Nifty50 (Jain, 2018). The present research enables to decide an investment pattern in Gold ETF / physical Gold.

III. AIM

The primary aim of the analytics is to create analytics among the investment option between physical Gold and Gold Exchange Traded Funds. The analytics also aims to answer the following queries.

- What is the reason for substantial outflow of funds from Gold ETF as compared to physical Gold?
- Whether Gold price and Gold ETF price are having variation in the long run?
- Whether the returns from Gold and Gold ETFs differ in short-term?
- Whether the bullish/bearish trend of physical Gold is having an impact on Gold ETF?

We assume that investors are rational, and the prices of Gold / Gold ETF represent the sentiments of the investors in the perfect market.

IV. METHODOLOGY

The Gold prices for the period 1st April 2017 to 31st March 2018 are collected from the World Gold Council. The price of the Gold per ounce is converted into price per gram. We consider two Indian Gold ETFs prices. It includes UTI – Gold Exchange ETF which is listed in Bombay Stock Exchange and Reliance Gold BeES (GBES), which is listed in National Stock Exchange. We collect the daily prices of Gold ETF from BSE and NSE for the period 2017-18. The prices during 245 working days in the year are collected. The figure -1 shows the design of the analytics.

The decision criteria quoted in the exhibit are based on the past research findings. The first decision criteria about the linear long-run equilibrium of the prices of Gold and Gold ETFs are based on econometrical problems of cointegration (Granger, 1986). The second decision criteria are based on the research findings of Brownetal (2004) with respect to investor sentiments and its relation to near-term stock market returns. The third decision criteria are based on the research findings of Lee et al (2002) with respect to the magnitude of bullish/bearish changes and sentiments of investors. The fourth decision criteria are based on the research findings of Rodriguez (2004) with respect to the discriminatory power of classifier through the area under the receiver operative curve (ROC) on the stock market indices movements.

V. ANALYSIS

5.1: Stage I: Determination of Cointegration - Whether the Gold and Gold ETF prices have long-term equilibrium trend?

The purpose of finding the relationship between the Gold Price and Gold ETF price is to identify the variation among the prices in the long run. If there is no long-run equilibrium among the prices of Gold and Gold ETF, then

the investors' perception may be negative towards the Gold ETF from 2017 through 2018. Otherwise, we have to identify the relationship between the deviations in short-term returns.

The non-stationarity among the Gold price movements are studied before studying the order on integration with Gold prices. The Augmented Dickey-Fuller unit root test has been used to examine the stationarity of the time series. The critical value of ADF test, at 1% level of significance is -3.460453. The calculated value of ADF test (Gold Price of 245 days in 2017-18) is -1.346. ADF test signifies that the lag price series of Gold is volatile, and the prices have the non-stationary trend. The Johansen's cointegration test has been applied to check whether the long run equilibrium relation exists between the variables. The results of the Co-integration tests with lag -2 are mentioned in Table – 1.

COINTEGRATION BETWEEN GOLD AND GOLD ETF

Sl.No	Variables	Statistic	Table Value	Critical Value	Probability	Result (95% CF)
1	Gold Prices and UTI ETF	Trace Statistic	26.97745	15.49471	0.00	Co-integrated
2	Gold Prices and UTI ETF	Max Eigen Statistic	23.40368	14.26460	0.0014	Co-integrated
3	Gold Prices and GBES ETF	Trace Statistic	18.80604	15.49471	0.02	Co-integrated
4	Gold Prices and GBES ETF	Max Eigen Statistic	16.94189	14.26460	0.005	Co-integrated

The result shows that there is a co-integration between the price of Gold with UTI ETF and GBES ETF. Hence we conclude that the investors' negative perception towards Gold ETF is not due to price volatility between the Gold price and ETF price in long run.

5.2 Stage II: Determination of Correlation Whether the returns from Gold & Gold ETF are correlated?

To explore the short-term trend between Gold and Gold ETF prices, we compare the intra-day returns of Gold and Gold ETFs. The intra-day returns are calculated based on the spread between consecutive two days. The results are in table -2

TABLE-2 KARL-PEARSON CO-EFFICIENT OF CORRELATION AMONG INTRADAY RETURNS

Variable	Intraday Gold returns	Intraday GBES ETF Returns	Intraday UTI ETF Returns
Intraday Gold returns	1		
Intraday GBES ETF Returns	0.423	1	
Intraday UTI ETF Returns	0.193	0.290	1

The correlation among the three variables is less than 0.5, which indicates that the returns are not exactly going on in

the same direction in the short-term. As the correlation is less than 0.5, we conclude that returns from Gold ETF and Gold are in a dis-equilibrium level. Hence, we conclude that the negative perception of investors towards the Gold ETF is due to the intraday volatility of returns from ETF as compared with Gold intraday returns.

5.3 Stage III – What is the Phenomenon ?

Even though there is a cointegration among the physical Gold prices and Gold ETF, the outflow of funds by the investors from Gold ETF is high during the period 2017-18. The reason for the substantial outflow of funds from Gold ETF is due to less return in Gold ETF as compared to physical Gold. Hence the intraday returns of physical Gold and Gold ETF are not correlated. The actual returns during the different situations are presented in table-3

TABLE 3 RETURNS FROM PHYSICAL GOLD AND GOLD ETF DURING 2017-18 (IN PERCENTAGE)

Sl.No	Returns on Investments	Intraday returns - High	Intraday returns - Low	Average Yearly Returns	Maximum Returns
1	Returns from Physical Gold	3.29	-2.41	7.2	12.9
2	Returns from UTI ETF	2.78	-1.70	6.7	10.8
3	Returns from GBES ETF	2.04	-1.19	5.2	10.1

The above table reveals that the returns from physical Gold are comparatively higher than that of the returns from Gold ETF. Hence, we conclude that the rational investors are considering the returns on Gold rather than the price of Gold. Since the investors are perceived with the returns on Gold rather than the price, the perception analysis should also be based on the returns from investment. As the Gold ETF returns have either the bullish trend or bearish trend, we aim to find out the prediction based upon these two trends.

5.4 Stage IV: Clustering: Whether the returns can be classified into bullish/ bearish trend?

We use K-means of clustering under unsupervised learning system using 'R' programming to classify the periods having the bullish trend or bearish trend based on the returns from Gold and Gold ETF. The 2-means of the clustering algorithm is determined. Three sets of variables, ie, intraday return on physical Gold, UTI ETF, and GBES

ETF are considered as the attitudinal variables. The table - 4 shows the initial and final cluster centroid values after six iterations.

TABLE 4 K-MEANS OF CLUSTER CENTROID VALUES

Sl.No	Variables	Initial Cluster Centroids		Final Cluster Centroids (After iterations)	
		Cluster 1	Cluster 2	Cluster 1	Cluster 2
1	Intraday returns of Physical Gold	0.56	0.63	-0.18	0.61
2	Intraday returns of UTI ETF	0.66	0.55	-0.21	0.69
3	Intraday returns of GBES ETF	-2.41	3.29	-0.14	0.51

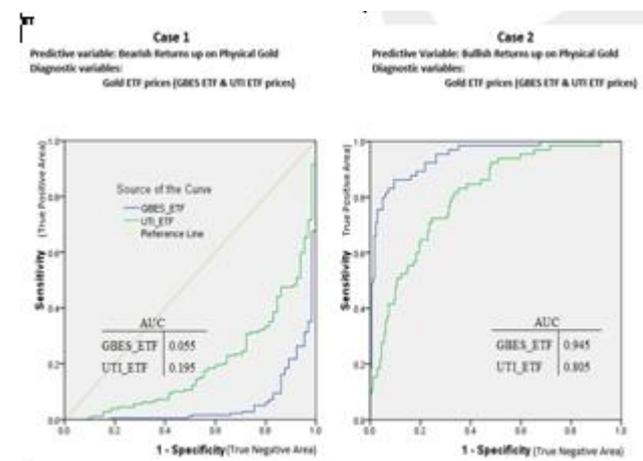
TABLE 5 CLUSTER ITERATIONS

Cluster Number	Iterations (change in cluster centroids)						Final Distance	Number of days in each cluster	Derived Name of the Clusters
	1	2	3	4	5	6			
1	2.49	0.099	0.091	0.045	0.015	0.0	(1.354)	179	Bearish Days
2	2.51	0.269	0.229	0.120	0.043	0.0	1.354	66	Bullish Days

The k-means of algorithm ends at the sixth iteration, as we arrive the value 0 as the change in cluster centroid values. The final distance between the clusters is 1.354. Based on the intraday returns as the cluster centroid value, 179 days are classified as bearish days and 66 days as bullish days. As the mean value of intraday returns of first cluster value is less than zero, those period are classified as ‘bearish’ period and the balance days as ‘bullish’ period.

5.5 Stage V- Diagnosis Test : Whether we can diagnose the Bearish / bullish returns of physical Gold using Gold ETF?

We aim to visualize the performance of the 2-k means classification problem with respect to Gold ETFs. We estimate the ROC curve to diagnose bearish returns / bullish returns from Gold ETFs in two ways. The clusters created based on the bearish and bullish trend of intra-day returns are considered as binary variables. Two situations are formulated to visualize the impact.



In the first case, the proportion of Gold ETFs prices that were identified correctly to the bearish returns (i.e., True Positive) is called as Sensitivity. Similarly, the proportion of Gold ETFs that were identified correctly not have bearish returns (i.e., True Negative) is called as Specificity.

In the second case, the proportion of Gold ETF prices that were identified correctly to the bullish returns (i.e., True Positive) is called as Sensitivity. Similarly, the proportion of Gold ETFs that were identified correctly not have bullish returns (i.e., True Negative) is called as Specificity. ROC curves and ROC/ AUC were calculated with ROC package through R programming. Figure -2 shows the ROC curve in two cases.

Figure 2: ROC Analysis during Bearish and Bullish Trends

In the first case, the area under the curve is 0.055 and 0.195 for Gold ETFs of GBES and UTI ETF respectively. In the second case, the area under the curve for Gold ETFs is 0.945 and 0.805 respectively for GBES and UTI ETFs. Since the AUC under the second case is more than 0.8, we conclude that bullish returns on physical Gold can be diagnosed with the price of Gold ETFs. However, bearish returns of Gold can't be diagnosed with the Gold ETFs. Hence, during the bearish trend in the Gold prices, we can't hedge the negative returns of Gold with Gold ETFs. During the period 2017-18, 169 days are classified as the bearish period (refer K-means of clustering results), but 66 days are only classified as the bullish period. Since the investors in Gold ETF are unable to hedge the loss for 169 days, (bearish period) the outflow from Gold ETF is high during the period 2017-18. The results also stand good during the bullish period in October 2018 (Financial Express, Nov.8, 2018).

VI. FINDINGS AND CONCLUSION

Even though the Gold price and the price of Gold ETFs are having long-term equilibrium trend, the investors are not preferring the Gold ETFs. One of the reasons is due to high deviation among the intra-day returns from Gold and Gold ETF. Since the investors are considering the returns on Gold, the classification of periods (such as bullish and bearish) can be done based on the returns from Gold and Gold ETFs. During the bullish period, the returns from Gold and Gold ETFs are moving in the same direction, and it is predictable. However, during the bearish trend, the trend among the Gold and Gold ETFs returns are not predictable. If any hedging of Gold price is required during the bearish period, the Gold ETFs cannot hold a good estimator. Exhibit – 3 shows the predictive analytics based on descriptive analytics about the investors' perception.

Exhibit 3: Predictive Analytics of Investment in Gold/Gold ETF

The K-means of clustering under unsupervised machine level learning is useful for classifying the returns based on the returns generated from Gold / Gold ETFs as the bullish and bearish period. The receiver operating characteristics curve (ROC) in machine learning also enables to diagnose

the trend of Gold/ Gold ETF returns during high volatility environment.

We conclude that the investment in Gold ETF is not a substitute for Gold even though the prices of both are correlated. The bearish trend in Gold ETF may be hedged through Gold but not vice-versa. The reason for the adverse effect has been portrayed in the ROC curve. During the bearish trend, the mutual fund organizations of Gold ETFs are unable to market the product; whereas, in the case of physical Gold, investors do not have a negative perception. However, during the bullish trend, the investment in both physical Gold and Gold ETFs are yielding same returns.

The marketers of the physical Gold will also decide about the investor's preference during the bearish period of Gold prices. We conclude that during bearish trend of Gold prices, the investors prefer Gold rather than their substitutes. As the Gold ETF is a not a substitute for physical Gold for investment in Indian diaspora, we need a separate descriptive Analytics during disruptive periods of Investments.

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