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Pricing Efficiency of Exchange Traded Funds in India

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Abstract

This study empirically examines the pricing efficiency of Exchange Traded Funds (ETFs) in India in terms of the deviations of price from Net Asset Value (NAV) as well as the persistence of such deviations. A sample of twelve ETFs listed on the National Stock Exchange of India has been analyzed in this study over a period ranging from January 2002 to December 2009. We find evidence of significant pricing deviations (premiums and discounts) for all the ETFs analyzed in this study. Moreover, such deviations are found to persist over a number of days for most of the ETFs. These findings indicate gross pricing inefficiencies and the presence of unexploited arbitrage opportunities in the Indian ETF market which commands immediate attention of the market players. To the best of our knowledge there has been no previous published research study which empirically examines the pricing efficiency of Exchange Traded Funds in India and this is the first such attempt in this direction.

Keywords: Exchange Traded Funds, Pricing Efficiency, Premiums and Discounts.

INTRODUCTION

One of the most dynamic new investment vehicles in the market today is Exchange Traded Fund (ETF), a security that tracks a stock index, a commodity or a basket of assets like an index fund, but trades on a securities exchange like a stock. ETFs are hybrid investment instruments combining the advantages of both open-end mutual funds and closed-end funds. They combine the creation and redemption process of the former with the continuous stock market tradability of the latter. This is made possible by the dual structure of the ETF trading process with a primary market open to authorized participants (mainly institutional investors) for the 'in-kind' creation and redemption of ETF shares in lots directly from the fund, and a secondary market open to all investors, where ETF shares can be traded on real time basis, with no limitation on order size.

Since an ETF is negotiated on two markets, it has two prices: the NAV of the shares on the basis of which creation and redemption takes place in the primary market and the price in the secondary market which depends on the supply and demand for ETF shares on the exchange. If buying or selling pressure is high, these two prices may deviate from one another. However, the possibility of 'in-kind' creation and redemption facilitates an arbitrage mechanism which ensures that such departures are not too large. For example, if ETF shares begin to trade at a price

below the NAV (i.e. at discount), arbitrageurs may purchase ETF shares in secondary market and after accumulating enough shares to equal a creation unit, redeem the shares from the fund and thereby acquire the underlying securities in the index, which the arbitrageur may then liquidate at a profit. A similar and reverse process may apply in case of ETF trading at a premium. An effective execution of this arbitrage mechanism would thus enable the ETFs to trade at prices equal to or very close to their NAVs, thereby eliminating the problem of significant premiums or discounts often associated with closed-end mutual funds.

There is an emerging literature on the pricing efficiency of ETFs being traded all over the world. However, the same is not true for India. To the best of our knowledge, the present study conducts the first empirical research on the pricing efficiency of ETFs in India. More specifically, the study examines the presence as well as the persistence of premiums and discounts of ETFs traded in India. The remainder of this paper is organized as follows. Section 2 offers a brief review of literature on the pricing efficiency of ETFs being traded in different parts of the world. The data and methodology are described in Section 3. Section 4 presents the empirical findings of the study. Section 5 summarizes and concludes the paper.

Review of Literature

In this section we review the literature on the pricing efficiency of Exchange Traded Funds being traded around the globe. Ackert and Tian (2000) compare the pricing efficiency of SPDRs (the first official ETF in the world) with that of Mid Cap SPDRs. They find that SPDRs do not trade at economically significant discounts, unlike closed-end mutual fund shares. Though consistent with their expectations, they report larger discount for MidCap SPDRs which are likely to have higher arbitrage costs due to higher fundamental risk, higher transactions costs, and lower dividend yields. Elton et al (2002) examine the pricing efficiency and volume determinants of SPDR over the period 1993-1998. Examining the extent of deviation of price from NAV in both absolute and percentage terms, they find that on average price lies below NAV by 1.4 cents or 0.018%. Moreover, these small deviations of price from NAV do not persist, and disappear in a day due to arbitrage mechanism. Regarding the trading volume they report that, in 1998 over 10% of the outstanding shares of SPDR were traded each day, which indicates that short term traders are active participants in the market. Hughen (2003) tests the efficacy of ETF arbitrage mechanism by examining the premiums on the shares of Malaysian fund listed on the American Stock Exchange, which is the only ETF that has experienced an extended suspension of arbitrage. The result supports the hypothesis that ETF premiums are influenced by the availability and cost of fund facilitated arbitrage.

Ares and Lavin (2004) study the pricing efficiency of Japan and Hong Kong shares ETFs that trade on American exchanges and find that asynchronous trading of the ETF and the underlying portfolio, and the constant flow of information in the marketplace gives rise to frequent discounts and premiums on such ETFs. Moreover, they document a positive relationship between the returns and lagged deviations, indicating the existence of exploitable inefficiencies. Gallagher and Segara (2004) examine the trading characteristics of Australian ETFs. They document small dollar and percentage differences in price and NAV that do not persist over time, but

rather disappear within a day, indicating the pricing efficiency of Australian ETF market. However, an analysis of the trading profile of ETFs reveals lack of trading activity for ETFs in Australia, since the average trading volume of ETFs as a percentage of total issues outstanding was found to be below 0.5% over most of the time periods analyzed. Lin, Chan and Hsu (2006) investigate the pricing efficiency of TTT, Taiwan's first ETF. The findings of the study suggest that the TTT sells at a premium, though at 0.041% the premium is not statistically significant. In terms of absolute mispricing value, a statistically significant deviation of 0.383% exists, though it is economically insignificant after considering the costs related to arbitrage. The authors conclude that the TTT is price efficient.

Engle and Sarkar (2006) examine the pricing efficiency of both domestic and international ETFs. They report smaller premiums and discounts for the domestic ETFs which last only several minutes. For international ETFs, they find much larger and more persistent deviations, frequently lasting several days. This evidence suggests higher pricing efficiency of domestic ETFs in comparison to international ETFs. Kayali (2007) investigates the pricing efficiency of Dow Jones Istanbul 20 (DJIST), the first ETF in Turkey. The author documents a statistically significant but small discount on average, which, considering the transaction costs associated with arbitrage, seem to be economically insignificant. Further, the results show that the premium or discount does not persist over time and disappears within two days, indicating the efficiency of the market for DJIST. Ackert and Tian (2008) examine the pricing of a sample of 28 U.S and country ETFs in relation to their fundamental values. They find that while the U.S. funds are priced closely to their net asset values, the country funds are not and can exhibit large, positive autocorrelations in fund premium which is related to momentum, illiquidity, and size effects.

Data and Methodology

Data

In India we have a fairly short time-series of ETFs, with the first ETF being launched on the National Stock Exchange in December 2001. Table 1 provides a profile of all existing ETFs listed on Indian Stock Exchanges by the end of September 2010. The present study analyses the pricing efficiency of a sample of twelve ETFs, comprising all the equity and gold ETFs listed on the National Stock Exchange of India by the year end 2009. The time period under study extends from 1st January 2002 to 31st December 2009 and each selected ETF has been analyzed over a time period beginning from the first full calendar year of its trading till the end of the period of study1. Table 2 provides a list of selected ETFs along with their respective study periods. The study uses daily trading data relating to price, volume and turnover of ETFs, which have been obtained from the website of NSE India. Moreover, the study uses daily NAV data for ETFs which have been gathered from the website of Association of Mutual Funds of India (AMFI) as well as the websites of their respective Asset Management Companies.

Table 1: Exchange Traded Funds (ETFs) in India

Name of ETF	ETF symbol	Fund house	Index tracked and exchange listed on	Listing date	Price per unit
Nifty BeES	NIFTYBEES	Benchmark Mutual Fund	S&P CNX Nifty, NSE	8-Jan-2002	1/10 of index
Sensex Prudential ICICI ETF	SPICE	ICICI Prudential Mutual Fund	Sensex, BSE	13-Jan-2003	1/100 of index
Junior Nifty BeES	JUNIORBEES	Benchmark Mutual Fund	CNX Nifty Junior, NSE	6-Mar-2003	1/100 of index
S&P CNX Nifty UTI National Depository Receipt Scheme	SUNDER	UTI Mutual Fund	S&P CNX Nifty, NSE	16-Jul-2003	1/10 of index
Liquid BeES	LIQUIDBEES	Benchmark Mutual Fund	Money market instruments, NSE	16-Jul-2003	Face value = Rs.1000 per unit
Bank BeES	BANKBEES	Benchmark Mutual Fund	CNX Bank Nifty, NSE	4-Jun-2004	1/10 of index
Gold BeES	GOLDBEES	Benchmark Mutual Fund	Domestic gold prices, NSE	19-Mar-2007	1 gram gold
UTI Gold ETF	GOLDSHARE	UTI Mutual Fund	Domestic gold prices, NSE	17-Apr-2007	1 gram gold
Kotak Gold ETF	KOTAKGOLD	Kotak Mutual Fund	Domestic gold prices, NSE	8-Aug-2007	1 gram gold
PSU Bank BeES	PSUBNKBEES	Benchmark Mutual Fund	CNX PSU Bank, NSE	1-Nov-2007	1/10 of index
Kotak PSU Bank ETF	KOTAKPSUBK	Kotak Mutual Fund	CNX PSU Bank, NSE	16-Nov-2007	1/10 of index
Reliance Gold ETF	RELGOLD	Reliance Mutual Fund	Domestic gold prices, NSE	26-Nov-2007	1 gram gold
Quantum Gold ETF	QUANTUMGOLD	Quantum Mutual Fund	Domestic gold prices, NSE	28-Feb-2008	1/2 gram gold
Kotak Sensex ETF	KOTAKSENSEX	Kotak Mutual Fund	Sensex, BSE	16-Jun-2008	1/100 of index
Reliance Banking ETF	RELBANK	Reliance Mutual Fund	CNX Bank Nifty, NSE	27-Jun-2008	1/10 of index
Quantum Nifty ETF	QNIFTY	Quantum Mutual Fund	S&P CNX Nifty, NSE	18-Jul-2008	1/10 of index
Shariah BeES	SHARIABEES	Benchmark Mutual Fund	S&P CNX Nifty Shariah, NSE	1-Apr-2009	1/10 of index
SBI Gold ETS	SBIGETS	SBI Mutual Fund	Domestic gold prices, NSE	28-May-2009	1 gram gold
Kotak Nifty	KOTAKNIFTY	Kotak Mutual Fund	S&P CNX Nifty, NSE	11-Feb-2010	1/10 of index
Hang Seng BeES	HNGSNGBEES	Benchmark Mutual Fund	Hang Seng Index, NSE	18-Mar-2010	1/100 of index
Religare Gold	RELIGAREGO	Religare Mutual Fund	Domestic gold prices, NSE	22-Mar-2010	1 gram gold
Motilal Oswal Most Shares M50 ETF	M50	Motilal Oswal Mutual Fund	Most 50 Basket, NSE	30-Jul-2010	–
HDFC Gold ETF	HDFC MF GETF	HDFC Mutual Fund	Domestic gold prices, NSE	19-Aug-2010	1 gram gold
ICICI Prudential Gold ETF	IPGETF	ICICI Prudential Mutual Fund	Domestic gold prices, NSE	2-Sep-2010	1 gram gold

Table 2: ETFs selected for the study

ETF	Index tracked	Date of listing	Period under study
NIFTYBEES	S&P CNX Nifty	8-Jan-2002	8Jan 02 - 31Dec 09
JUNIORBEES	CNX Nifty Junior	6-Mar-2003	1Jan 06 - 31Dec 09
BANKBEES	Bank Nifty	4-Jun-2004	1Jan 07 - 31Dec 09
GOLDBEES	Gold Prices	19-Mar-2007	1Jan 08 - 31Dec 09
GOLDSHARE	Gold Prices	17-Apr-2007	1Jan 08 - 31Dec 09
KOTAKGOLD	Gold Prices	8-Aug-2007	1Jan 08 - 31Dec 09
PSUBNKBEES	CNX PSU Bank	1-Nov-2007	1Jan 08 - 31Dec 09
KOTAKPSUBK	CNX PSU Bank	16-Nov-2007	1Jan 08 - 31Dec 09
RELGOLD	Gold Prices	26-Nov-2007	1Jan 08 - 31Dec 09
QGOLDHALF	Gold Prices	28-Feb-2008	1Jan 09 - 31Dec 09
RELBANK	CNX Bank Nifty	27-Jun-2008	1Jan 09 - 31Dec 09
QNIFTY	S&P CNX Nifty	18-Jul-2008	1Jan 09 - 31Dec 09

Methodology

For the analysis of pricing efficiency of ETFs, we first examine the extent of deviation of ETFs trading price from NAV, which represents both a cost to investors and an arbitrage opportunity for the market makers. The lesser the extent of such deviation, more efficient would be the pricing of ETFs. To undertake this analysis, we follow the methodology adopted by Elton et al. (2002) and Gallagher and Segara (2004). Accordingly, the study reports the frequency distribution and statistical characteristics of both the rupee difference between price and NAV as well as the difference in percentage terms (expressed as rupee difference divided by NAV). A positive rupee difference between price and NAV (i.e. when price exceeds NAV) indicates that the ETF trades at premium, whereas the reverse holds true for a discount.

After examining the presence of deviation of ETFs trading price from NAV, the next issue to be examined is the persistence or lack thereof in these deviations, i.e. whether the premium/discount (if any) disappears within a day, or persists over a number of days. To investigate this issue, a regression model is employed whereby the rupee difference between price and NAV of an ETF at the close of day 't' (Dt) is regressed with a constant (a) and its one day lagged variable (Dt-1). This can be expressed as model (1):

$$Dt = a + ß1\ Dt\text{-}1 \quad \ldots\ldots\ldots\ldots (1)$$

Here, an insignificant ß1 would indicate no persistence in deviations (as the lagged deviation does not explain present deviation), indicating that the premium/discount disappears within a day. However, if ß1 is found to be significant, it would indicate the persistence of premium/discount, and in such case more lags in the form of ß2 Dt-2, ß3 Dt-3 and so on will be included in model (1), until the beta coefficient of the last lag becomes insignificant. An ETF for which beta coefficients are found to be significant upto 'n' number of lags would indicate the persistence of premium/

discount over n number of days. Persistence in price deviation over a long period of time would indicate the inefficiency of arbitrage mechanism in the ETF marketplace. Additionally, in order to examine the trading activity in the ETF market, we report the average daily turnover as a percentage of fund value for each ETF at the end of each yearly interval.

Empirical Findings

Table 3 and Table 4 report the frequency distribution of the rupee difference between price and NAV of ETFs and the difference in percentage terms respectively. The tables show that on an average, price lies below NAV for nine out of twelve ETFs analyzed. For all the ETFs (except Relbank), mean daily difference between price and NAV ranges from -5.13 to 1.41 rupees. However, Relbank experiences exceptionally high deviations over the study period, which average -39.35 rupees. Similarly, the mean percentage difference between price and NAV ranges from -0.97% to 0.23% for all the ETFs (except Relbank), and equals -5.28% for Relbank.

Table 3: Frequency distribution of rupee difference between price and NAV of ETFs (i.e. price-NAV)

ETFs →	Niftybees		Juniorbees		Bankbees		Goldbees		Goldshare		Kotakgold	
Difference in price (Rs.)	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*
<= -40	0	0.00	0	0.00	0	0.00	16	3.30	23	4.74	20	4.18
-40 to -35	0	0.00	0	0.00	0	0.00	6	1.24	13	2.68	12	2.51
-35 to -30	0	0.00	0	0.00	0	0.00	10	2.06	9	1.86	10	2.09
-30 to -25	0	0.00	0	0.00	0	0.00	14	2.89	14	2.89	19	3.97
-25 to -20	0	0.00	0	0.00	1	0.14	16	3.30	30	6.19	15	3.14
-20 to -15	0	0.00	0	0.00	4	0.57	14	2.89	22	4.54	29	6.07
-15 to -10	1	0.05	0	0.00	12	1.70	33	6.80	32	6.60	28	5.86
-10 to -5	7	0.35	0	0.00	100	14.16	35	7.22	42	8.66	49	10.25
-5 to 0	1181	59.80	373	38.94	182	25.78	80	16.49	57	11.75	88	18.41
0 to 5	766	38.78	584	60.96	213	30.17	125	25.77	77	15.88	101	21.13
5 to 10	17	0.86	0	0.00	145	20.54	78	16.08	77	15.88	65	13.60
10 to 15	1	0.05	0	0.00	34	4.82	28	5.77	48	9.90	22	4.60
15 to 20	2	0.10	1	0.10	7	0.99	11	2.27	17	3.51	6	1.26
20 to 25	0	0.00	0	0.00	3	0.42	8	1.65	7	1.44	3	0.63
25 to 30	0	0.00	0	0.00	1	0.14	2	0.41	5	1.03	3	0.63
30 to 35	0	0.00	0	0.00	1	0.14	1	0.21	2	0.41	3	0.63
35 to 40	0	0.00	0	0.00	0	0.00	1	0.21	1	0.21	2	0.42
>40	0	0.00	0	0.00	3	0.42	7	1.44	9	1.86	3	0.63
Total	*1975*	*100.00*	*958*	*100.00*	*706*	*100.00*	*485*	*100.00*	*485*	*100.00*	*478*	*100.00*
Mean		-0.27		0.17		1.41		-2.39		-3.61		-5.13
Median		-0.27		0.16		1.52		0.59		0.07		-1.63
Maximum		19.52		16.26		57.20		77.60		77.86		74.85
Minimum		-11.23		-2.21		-21.40		-96.14		-99.81		-95.98
Std. Dev.		1.77		0.77		7.00		16.94		20.07		16.98
Skewness		1.46		9.73		1.54		-0.66		-0.46		-0.78
Kurtosis		19.97		200.47		12.91		8.04		6.20		6.97
Jarque-Bera		24405.46		1571579.00		3167.90		549.08		224.14		361.35
Probability		0.00		0.00		0.00		0.00		0.00		0.00

ETFs →	Psubankbees		Relgold		Kotakpsubk		Qgoldhalf		Relbank		Qnifty	
Difference in price (Rs.)	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*
<= -40	0	0.00	15	3.10	0	0.00	0	0.00	133	55.42	0	0.00
-40 to -35	0	0.00	9	1.86	0	0.00	0	0.00	14	5.83	0	0.00
-35 to -30	0	0.00	16	3.31	0	0.00	0	0.00	9	3.75	0	0.00
-30 to -25	0	0.00	15	3.10	1	0.22	2	0.83	12	5.00	1	0.43
-25 to -20	1	0.21	14	2.89	0	0.00	6	2.49	10	4.17	4	1.70
-20 to -15	0	0.00	24	4.96	1	0.22	16	6.64	7	2.92	3	1.28
-15 to -10	0	0.00	31	6.40	5	1.10	17	7.05	10	4.17	10	4.26
-10 to -5	14	2.94	65	13.43	46	10.15	16	6.64	8	3.33	68	28.94
-5 to 0	195	40.88	74	15.29	195	43.05	67	27.80	11	4.58	102	43.40
0 to 5	244	51.15	74	15.29	162	35.76	94	39.00	6	2.50	39	16.60
5 to 10	19	3.98	55	11.36	31	6.84	22	9.13	8	3.33	8	3.40
10 to 15	2	0.42	32	6.61	7	1.55	1	0.41	1	0.42	0	0.00
15 to 20	0	0.00	19	3.93	1	0.22	0	0.00	2	0.83	0	0.00
20 to 25	2	0.42	16	3.31	1	0.22	0	0.00	3	1.25	0	0.00
25 to 30	0	0.00	5	1.03	2	0.44	0	0.00	0	0.00	0	0.00
30 to 35	0	0.00	7	1.45	1	0.22	0	0.00	3	1.25	0	0.00
35 to 40	0	0.00	2	0.41	0	0.00	0	0.00	1	0.42	0	0.00
>40	0	0.00	11	2.27	0	0.00	0	0.00	2	0.83	0	0.00
Total	*477*	*100.00*	*484*	*100.00*	*453*	*100.00*	*241*	*100.00*	*240*	*100.00*	*235*	*100.00*
Mean		0.34		-2.05		-0.29		-2.36		-39.35		-3.80
Median		0.48		-1.52		-0.49		-0.15		-45.39		-3.64
Maximum		23.35		103.58		31.73		12.71		65.19		9.31
Minimum		-20.59		-89.00		-28.05		-26.53		-131.73		-25.56
Std. Dev.		3.32		20.14		5.17		7.57		29.75		5.20
Skewness		0.78		0.43		1.09		-1.26		0.57		-1.00
Kurtosis		13.50		7.67		11.80		3.88		3.23		5.87
Jarque-Bera		2240.75		454.19		1552.70		71.16		13.37		119.42
Probability		0.00		0.00		0.00		0.00		0.00		0.00

Table 4: Frequency distribution of percentage difference between price and NAV of ETFs (i.e. [(price-NAV)/NAV]*100)

ETFs →	Niftybees		Juniorbees		Bankbees		Goldbees		Goldshare		Kotakgold	
Difference in price (%)	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*
<= -4.0	0	0.00	0	0.00	0	0.00	6	1.24	10	2.06	4	0.84
-4.0 to -3.5	0	0.00	1	0.10	0	0.00	3	0.62	4	0.82	3	0.63
-3.5 to -3.0	0	0.00	0	0.00	1	0.14	5	1.03	6	1.24	5	1.05
-3.0 to -2.5	1	0.05	0	0.00	0	0.00	8	1.65	15	3.09	18	3.77
-2.5 to -2.0	7	0.35	3	0.31	4	0.57	16	3.30	22	4.54	20	4.18
-2.0 to -1.5	19	0.96	8	0.84	14	1.98	23	4.74	33	6.80	26	5.44
-1.5 to -1.0	60	3.04	31	3.24	42	5.95	29	5.98	32	6.60	39	8.16
-1.0 to -0.5	399	20.19	106	11.06	132	18.70	38	7.84	45	9.28	44	9.21
-0.5 to 0	703	35.58	224	23.38	106	15.01	96	19.79	75	15.46	111	23.22
0 to 0.5	558	28.24	267	27.87	128	18.13	153	31.55	115	23.71	133	27.82
0.5 to 1.0	180	9.11	216	22.55	159	22.52	65	13.40	74	15.26	45	9.41
1.0 to 1.5	23	1.16	59	6.16	80	11.33	21	4.33	26	5.36	15	3.14
1.5 to 2.0	11	0.56	19	1.98	19	2.69	11	2.27	9	1.86	4	0.84
2.0 to 2.5	7	0.35	14	1.46	9	1.27	2	0.41	8	1.65	3	0.63
2.5 to 3.0	2	0.10	2	0.21	5	0.71	1	0.21	2	0.41	3	0.63
3.0 to 3.5	1	0.05	3	0.31	4	0.57	1	0.21	1	0.21	2	0.42
3.5 to 4.0	1	0.05	0	0.00	0	0.00	4	0.82	1	0.21	0	0.00
>4.0	3	0.15	5	0.52	3	0.42	3	0.62	7	1.44	3	0.63
Total	*1975*	*100.00*	*958*	*100.00*	*706*	*100.00*	*485*	*100.00*	*485*	*100.00*	*478*	*100.00*
Mean		-0.11		0.23		0.18		-0.15		-0.25		-0.35
Median		-0.13		0.21		0.25		0.04		0.00		-0.12
Maximum		6.32		15.89		5.57		7.01		7.02		6.74
Minimum		-2.73		-3.73		-3.09		-6.72		-6.96		-6.69
Std. Dev.		0.63		0.95		0.96		1.31		1.55		1.27
Skewness		1.52		5.23		0.56		-0.05		0.00		-0.27
Kurtosis		16.04		81.46		5.51		8.98		6.82		7.55
Jarque-Bera		14744.91		250105.40		221.76		723.94		294.87		418.79
Probability		0.00		0.00		0.00		0.00		0.00		0.00

ETFs →	Psubankbees		Relgold		Kotakpsubk		Qgoldhalf		Relbank		Qnifty	
Difference in price (%)	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*	*Freq.*	*Proportion of observations*
<= -4.0	1	0.21	4	0.83	16	3.53	0	0.00	164	68.33	9	3.83
-4.0 to -3.5	1	0.21	4	0.83	4	0.88	3	1.24	6	2.50	6	2.55
-3.5 to -3.0	5	1.05	7	1.45	8	1.77	3	1.24	5	2.08	4	1.70
-3.0 to -2.5	3	0.63	10	2.07	10	2.21	10	4.15	15	6.25	7	2.98
-2.5 to -2.0	11	2.31	27	5.58	19	4.19	9	3.73	6	2.50	8	3.40
-2.0 to -1.5	19	3.98	18	3.72	36	7.95	13	5.39	3	1.25	22	9.36
-1.5 to -1.0	37	7.76	36	7.44	50	11.04	13	5.39	4	1.67	36	15.32
-1.0 to -0.5	69	14.47	55	11.36	58	12.80	12	4.98	7	2.92	48	20.43
-0.5 to 0	64	13.42	102	21.07	47	10.38	61	25.31	4	1.67	48	20.43
0 to 0.5	75	15.72	100	20.66	48	10.60	77	31.95	3	1.25	30	12.77
0.5 to 1.0	87	18.24	49	10.12	52	11.48	38	15.77	3	1.25	8	3.40
1.0 to 1.5	46	9.64	26	5.37	34	7.51	1	0.41	3	1.25	4	1.70
1.5 to 2.0	26	5.45	17	3.51	24	5.30	1	0.41	3	1.25	2	0.85
2.0 to 2.5	12	2.52	8	1.65	14	3.09	0	0.00	2	0.83	3	1.28
2.5 to 3.0	8	1.68	6	1.24	6	1.32	0	0.00	0	0.00	0	0.00
3.0 to 3.5	5	1.05	4	0.83	7	1.55	0	0.00	1	0.42	0	0.00
3.5 to 4.0	1	0.21	0	0.00	2	0.44	0	0.00	1	0.42	0	0.00
>4.0	7	1.47	11	2.27	18	3.97	0	0.00	10	4.17	0	0.00
Total	*477*	*100.00*	*484*	*100.00*	*453*	*100.00*	*241*	*100.00*	*240*	*100.00*	*235*	*100.00*
Mean		0.18		-0.10		-0.10		-0.33		-5.28		-0.97
Median		0.20		-0.12		-0.21		-0.02		-6.14		-0.81
Maximum		8.06		9.51		15.69		1.82		15.80		2.39
Minimum		-7.87		-6.34		-10.66		-3.70		-17.96		-7.79
Std. Dev.		1.44		1.62		2.28		1.04		4.50		1.46
Skewness		0.60		1.07		1.24		-1.32		1.19		-1.61
Kurtosis		8.93		9.47		11.68		4.12		5.70		7.84
Jarque-Bera		727.86		935.94		1537.94		82.04		129.33		331.58
Probability		0.00		0.00		0.00		0.00		0.00		0.00

Table 3: Frequency distribution of rupee difference between price and NAV of ETFs (i.e. price-NAV) Comparing these price deviations in Indian ETFs with some other ETF markets around the globe, the mean percentage difference equals 0.018% for Spiders as documented by Elton et al. (2002) and ranges between -0.03% to 0.06% for Australian ETFs as documented by Gallagher and Segara (2004). This comparison clearly reveals greater pricing inefficiency of the Indian ETF market.

While the mean deviations in price and NAV are high, there exists still higher variability in the deviations within each ETF. For example, although ETF named Kotakpsubk has a mean percentage difference of -0.10%, it ranges from -10.66% to 15.69% for the overall period under study for such ETF. For nine out of twelve ETFs analyzed in this study, more than 10% of the time, the percentage difference lies above 2%. For the other three ETFs it lies above 2% for less than 4% cases. However, for Relbank, such deviations exceed 2% in approximately 87% cases. When compared to the Australian ETFs and the Spiders, none of them experienced deviations above 2% on any day.

In general, these results suggest significantly high rupee as well as percentage difference in price and NAV of Indian ETFs. An issue that needs to be examined further is whether there is persistence or lack of it in such deviations, i.e. whether such high premiums/discounts experienced by Indian ETFs on any particular day persist over a number of days or disappear quickly. Table 5 reports the results of regression model employed to test the persistence in price deviations.

Table 5: Persistence of premiums / discounts in ETFs

($Dt = a + ß1\ Dt\text{-}1 + ß2\ Dt\text{-}2 + \ldots.$)

ETF name	Variable	Intercept (α)	D_{t-1}	D_{t-2}	D_{t-3}	D_{t-4}	Adjusted R^2	Persistence
Niftybees	Coefficient	-0.16	0.21	0.15	0.06		0.09	3 days
	Prob-value	*0.00*	*0.00*	*0.00*	*0.01*			
Juniobees	Coefficient	0.13	0.17	0.07			0.04	2 days
	Prob-value	*0.00*	*0.00*	*0.03*				
Bankbees	Coefficient	0.72	0.14	-0.02	0.24	0.12	0.11	4 days
	Prob-value	*0.01*	*0.00*	*0.58*	*0.00*	*0.00*		
Goldbees	Coefficient	-0.30	0.53	0.13	0.18		0.61	3 days
	Prob-value	*0.54*	*0.00*	*0.01*	*0.00*			
Goldshare	Coefficient	-0.44	0.57	0.14	0.15		0.64	3 days
	Prob-value	*0.43*	*0.00*	*0.01*	*0.00*			
Kotakgold	Coefficient	-0.79	0.52	0.14	0.18		0.59	3 days
	Prob-value	*0.14*	*0.00*	*0.01*	*0.00*			
Psubankbees	Coefficient	*0.31*	*0.14*	*-0.15*	*0.10*		0.04	3 days
	Prob-value	*0.04*	*0.00*	*0.00*	*0.03*			
Relgold	Coefficient	-0.23	0.65	0.12	0.10		0.69	3 days
	Prob-value	*0.66*	*0.00*	*0.03*	*0.02*			

Kotakpsubk	Coefficient	-0.27	0.03				0.00	No persistence
	Prob-value	*0.27*	*0.57*					
Qgoldhalf	Coefficient	-0.19	0.39	0.22	0.12	0.14	0.61	2-4 days
	Prob-value	*0.55*	*0.00*	*0.00*	*0.08*	*0.03*		
Relbank	Coefficient	-5.24	0.70	0.17			0.72	2 days
	Prob-value	*0.00*	*0.00*	*0.01*				
Qnifty	Coefficient	-2.11	0.33	0.14	-0.06		0.15	2 days
	Prob-value	*0.00*	*0.00*	*0.04*	*0.37*			

Table 5 shows significant intercept term (a) and R-squares for majority of the ETFs. More importantly, we find the slope of regression coefficients (ß) to be significant upto three lags for most of the ETFs, indicating the persistence of price deviations upto three days for such ETFs. Across all ETFs, persistence ranges from zero to four days, with Kotakpsubk being the only ETF for which the deviations do not persist, and disappear within a day.

These findings are again in contrast with the US findings of Elton et al. (2002) for Spiders and Australian findings of Gallagher and Segara (2004), who document that not only the deviations between price and NAV of ETFs are small, but also disappear within a day due to the effective arbitrage mechanism facilitated by ETF's unique trading system. The findings of this study thus highlight the pricing inefficiency of the Indian ETFs market, where not only significant pricing deviations exist but they also persist over a number of days. This clearly indicates the presence of ample arbitrage opportunities in the Indian ETFs market which have not yet been fully exploited by the market players. Though the present study does not attempt to quantify the profitability of such arbitrage opportunities, many of the price deviations appear to be too large to be accounted for solely by transaction cost.

Finally, we analyze the trading activity in the Indian ETF market in terms of average daily turnover as a percentage of fund's AUM. Table 6 shows that for all the ETFs, over most time intervals, less than 1% of the outstanding shares have been traded on each day. This indicates the low level of trading activity in the Indian ETF market which might be one of the possible reasons for the presence of and persistence in pricing inefficiency of ETFs in India.

Table 6: A trading profile of Exchange Traded Funds (ETFs)

ETF name	Period	Avg. daily trading volume (no. of shares)	Avg. daily turnover (in lakhs of Rs.)	Assets Under Management (in lakhs of Rs.)	Avg. daily turnover as a % of AUM
Niftybees	2002	20,416	21.97	n.a	n.a
	2003	8,856	10.52	n.a	n.a
	2004	5,162	9.25	n.a	n.a
	2005	6,385	14.27	n.a	n.a
	2006	6,831	23.21	n.a	n.a
	2007	12,874	60.08	39,164.50	0.15
	2008	72,018	242.55	12,841.34	1.89
	2009	145,256	602.44	44,704.87	1.35
	All	**34,190**	**120.89**	**44,704.87**	**0.27**

Juniorbees	2004	4,328	1.63	n.a	n.a
	2005	6,070	2.89	n.a	n.a
	2006	4,435	2.77	n a	n.a
	2007	3,096	2.86	7,463.40	0.04
	2008	8,083	6.01	592.52	1.01
	2009	41,842	34.67	6,113.98	0.57
	All	**11,730**	**8.90**	**6,113.98**	**0.15**
Bankbees	2005	1,902	7.65	n.a	n.a
	2006	1,039	5.09	n.a	n.a
	2007	588	4.03	552,011.00	0.00
	2008	39,355	256.17	131,589.12	0 19
	2009	2,752	20.13	9,111.30	0.22
	All	**10,874**	**70.46**	**9,111.30**	**0.77**
Goldbees	2008	17,452	215.53	27,387.90	0.79
	2009	25,231	393.76	60,170.28	0.65
	All	**21,318**	**304.10**	**60,170.28**	**0.51**
Goldshare	2008	5,811	71.62	18,067.01	0.40
	2009	5,337	82.37	25,575.63	0.32
	All	**5,576**	**76.96**	**25,575.63**	**0.30**
Kotakgold	2008	4,211	51.18	5,044.31	1.01
	2009	2,928	45.91	10,281.14	0.45
	All	**3,573**	**48.56**	**10,281.14**	**0.47**
Psubnkbees	2008	795	1.98	1,598.85	0.12
	2009	2,712	7.55	683.70	1.11
	All	**1,751**	**4.76**	**683.70**	**0.70**
Relgold	2008	5,634	68.83	19,837.22	0.35
	2009	5,902	89.33	24,717.42	0.36
	All	**5,767**	**79.02**	**24,717.42**	**0.32**
Kotakpsubk	2008	817	1.93	2,908.94	0.07
	2009	1,520	4.32	3,025.84	0.14
	All	**1,164**	**3.11**	**3,025.84**	**0.10**
Qgoldhalf	**2009**	**788**	**6.00**	**1,497.86**	**0.40**
Relbank	**2009**	**389**	**2.63**	**1,351.50**	**0.19**
Qnifty	**2009**	**122**	**0.49**	**118.69**	**0.41**

5. Summary and Conclusions

Theoretically, ETFs are considered to be price efficient due to their unique dual trading system which ensures that any significant deviation between price and NAV of an ETF is easily arbitrage away by the market players. In this paper we empirically analyze this pricing efficiency of ETFs by firstly quantifying the deviation between price and NAV of ETFs in rupee as well as percentage terms, and then testing the persistence of such deviations.

The findings of the study indicate considerable deviations between price and NAV of all the ETFs analyzed in this study, and exceptionally high deviations for one of the ETFs named Relbank. For majority of the ETFs, such deviations exceed 2% on more than 10% of the trading days. Such high pricing deviations present ample arbitrage opportunities for the market makers in the ETF market place, which if exploited, could eliminate such deviations quickly. However, the findings of the

study reveal that such pricing deviations persist for upto three days for most of the ETFs analyzed in this study, thereby indicating ineffectiveness of the arbitrage mechanism in the Indian ETF market.

The study also finds evidence of very low trading activity in the Indian ETF market as indicated by low average daily turnover of ETFs as a percentage of fund's assets. This indicates shallowness of the Indian ETF market, which could be one of the possible reasons explaining the pricing inefficiency in the market.

Overall, the study points out gross pricing inefficiency and unexploited arbitrage opportunities in the Indian ETF market which command immediate attention of the market players. There is also a need to examine the causes of the lack of trading activity and the resulting pricing inefficiency in the Indian ETF market, towards which future researches may focus.

Footnotes

1 Due to the poor trading history, an ETF named SUNDER is excluded from the study. For the same reason, the first two full calendar years of trading of ETFs named BANKBEES and JUNIORBEES are also excluded. Moreover, the dates on which ETF price data or NAV data are unavailable are not included in the analysis.

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