

Are Trading Rules Profitable in Exchange-Traded Funds?

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Received March 1, 2011; revised April 28, 2011; accepted May 4, 2011

Abstract

The Exchange-traded fund (ETF) is a burgeoning financial vehicle. Despite its growing importance, there has been a lack of empirical studies on the profitability of technical trading rules in the ETF market. This paper assesses the profitability of the On-Balance Volume indicator (OBV) on ETF trading. It is found that the trading rules associated with the OBV are able to generate handsome returns in the ETF market. This is **in contrast to** the conventional wisdom that funds should be bought and held.

Keywords: On-Balance Volume, Exchange-Traded Funds, Moving Average

1. Introduction

A wide variety of nascent financial vehicles have been developed in recent years. In particular, the Exchange-traded fund (ETF), among other financial innovations, has become a burgeoning financial vehicle and gained the attention of the populace. ETFs have a relatively short history. The world's first ETF was launched in 1993, with a total asset value of US \$484 million. By the end of 2010, there are over 1000 ETFs traded on US exchanges, with a total asset value of more than US \$790 billion, reflecting a growing demand for this new financial vehicle.¹ Compared to mutual funds, ETFs offer have a variety of advantages, such as a greater flexibility, lower fee, increased tax efficiency and greater transparency [1].² Traditional performance metrics, such as Price/Earnings ratio and cash flow, cannot be applied to trade ETFs [2]. This paper examines a topical research area. Following Tsang and Chong [3], we evaluate the performance of the On-Balance Volume (OBV) indicator in the ETF market. The *OBV* is a simple indicator defined as:

$$OBV_t = \begin{cases} OBV_{t-1} + V_t, C_t > C_{t-1} \\ OBV_{t-1} - V_t, C_t < C_{t-1} \\ OBV_{t-1}, C_t = C_{t-1} \end{cases}$$

where C_t and V_t are the closing price and trading volume

respectively at time t . We let OBV_0 to be zero. A rising price together with a rising *OBV* indicates that the volume is heavier on up days, confirming the uptrend of the market. If prices are moving higher while the volume is falling, it suggests a trend reversal.

2. Data and Methodology

Our sample includes 30 US listed ETFs³ from six different categories, namely, Bear Market, Latin America, Telecommunications, Consumers Staples, Bond and Government Treasury Bills.⁴ Following Tsang and Chong [3], we employ the trading rules associated with the *OBV* indicator.⁵ Five trading rules are studied. The first four rules are based on the crossing of *OBV* and its n -day moving average, which is defined as:

$$OBVMA_t^n = \frac{1}{n} \sum_{i=1}^n OBV_i$$

A trading signal is produced when *OBV* crosses the corresponding moving average. The fifth rule is based on the crossing of two *OBV* moving averages. The five *OBV* rules are defined as follows:

³According to the definition of Morning Star, ETFs that mainly hold US Treasury Bills are categorized as Short Government, Intermediate Government and Long Government. In our analysis, we define US Treasury Bills category as any ETFs falling into these three categories.

⁴These classifications, except for US Treasury Bills, are set by the ETFs' corresponding issuers.

⁵We derive the *OBV* indicator using the trading volume of the ETFs, instead of the trading volume of the underlying assets.

¹The exact number of ETFs depends on the definition employed, as there are many other ETF-like products listed in different exchanges [1].

²For recent studies on ETFs, see [4] and [5].

Rule 1: 10-day OBV

Buy at day t : $OBV_{t-1} < OBVMA_{t-1}^{10}$ and $OBV_t > OBVMA_t^{10}$

Sell at day t : $OBV_{t-1} > OBVMA_{t-1}^{10}$ and $OBV_t < OBVMA_t^{10}$

Rule 2: 20-day OBV

Buy at day t : $OBV_{t-1} < OBVMA_{t-1}^{20}$ and $OBV_t > OBVMA_t^{20}$

Sell at day t : $OBV_{t-1} > OBVMA_{t-1}^{20}$ and $OBV_t < OBVMA_t^{20}$

Rule 3: 50-day OBV

Buy at day t : $OBV_{t-1} < OBVMA_{t-1}^{50}$ and $OBV_t > OBVMA_t^{50}$

Sell at day t : $OBV_{t-1} > OBVMA_{t-1}^{50}$ and $OBV_t < OBVMA_t^{50}$

Rule 4: 100-day OBV

Buy at day t : $OBV_{t-1} < OBVMA_{t-1}^{100}$ and $OBV_t > OBVMA_t^{100}$

Sell at day t : $OBV_{t-1} > OBVMA_{t-1}^{100}$ and $OBV_t < OBVMA_t^{100}$

The fifth trading rule, which is based on the crossing of 10-day $OBVMA$ and 20-day $OBVMA$, is defined as follows:

Rule 5: $OBVMA_{10} \times 20$

Buy at day t : $OBVMA_{t-1}^{10} < OBVMA_{t-1}^{20}$ and $OBVMA_t^{10} > OBVMA_t^{20}$

Sell at day t : $OBVMA_{t-1}^{10} > OBVMA_{t-1}^{20}$ and

$$OBVMA_t^{10} < OBVMA_t^{20}$$

For the first four rules, a long position will be taken if OBV rises above the corresponding $OBVMA$, and liquidated when OBV falls below the corresponding $OBVMA$. The choices of the four window length $n = 10, 20, 50$ and 100 are common (Brock *et al.* [6], Tsang and Chong [3]). If a smaller value of n is used, there will be many noisy signals. For long-term investment, one may use a larger value of n to reduce the number of transactions.

We prohibit short-selling and consecutive buying/selling in our calculation of returns.⁶ Transaction cost is assumed to be negligible. The performance of the five trading rules is evaluated in terms of the annualized rate of return. Since there are about 250 trading days each year, the annualized rate of return can be defined as follows:

$$R_A = [(1+r_1)(1+r_2)(1+r_3)\dots(1+r_m)]^{250/T} - 1$$

where

$$1+r_i = S(i)/B(i),$$

$S(i)$ and $B(i)$ are respectively the selling and buying prices of the i^{th} transaction;

m is the number of transactions in the sample;

T is the number of trading days in the sample.⁷

To assess the impact of the 2008 Financial Tsunami on the profitability of our trading rules, we further split the whole sample into Pre-Tsunami and Post-Tsunami subsamples. The day when Lehman Brothers Holdings Inc. was delisted from the New York Stock Exchange, 17th September 2008, was set as the watershed. This is the major event that marks the onset of the Financial Tsunami. The daily closing prices and volume of each ETF are gleaned from DataStream. The details are reported in **Table 1**.

Table 1. ETF name list and time period.

Bear Market Category		Overall	Pre-Tsunami	Post-Tsunami
Ticker	ETF Name			
SIJ	ProShares UltraShort Industrials			
SH	ProShares Short S&P500			
DOG	ProShares Short Dow30			
UDN	PowerShares DB US Dollar Index Bearish Fund	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10
SRS	ProShares UltraShort Real Estate			
SMN	ProShares UltraShort Basic Materials			
SKF	ProShares UltraShort Financials			
DUG	ProShares UltraShort Oil & Gas			

⁶Short selling means the short selling of the ETF itself. ETFs in the Bear Market Category sometimes adopt a strategy of short-selling its underlying asset.

⁷Suppose we start with one dollar of investment, then $[(1+r_1)(1+r_2)(1+r_3)\dots(1+r_m)]$ will be the total return after all the m transactions during period T . After taking the power of $250/T$, and less the initial one dollar, we obtain the annualized rate of return.

Latin America Category

Ticker	ETF Name	Overall	Pre-Tsunami	Post-Tsunami
EWZ	iShares MSCI Brazil Index Fund			
ILF	iShares S&P Latin America 40 Index Fund	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10

Telecommunications Category

Ticker	ETF Name	Overall	Pre-Tsunami	Post-Tsunami
IXP	iShares S&P Global Telecommunications Sector Index Fund			
VOX	Vanguard Telecommunication Services ETF	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10
PBS	PowerShares Dynamic Media Portfolio			

Consumer Staples Category

Ticker	ETF Name	Overall	Pre-Tsunami	Post-Tsunami
XLP	Consumer Staples Select Sector SPDR	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10
VDC	Vanguard Consumer Staples ETF			

Bond Category

Ticker	ETF Name	Overall	Pre-Tsunami	Post-Tsunami
HYG	iShares iBoxx \$ High Yield Corporate Bond Fund	11/4/07-17/3/10	11/4/07-17/9/08	
GBF	iShares Barclays Government/Credit Bond Fund	13/3/07-17/3/10	13/3/07-17/9/08	
BSV	Vanguard Short-Term Bond ETF	10/4/07-17/3/10	10/4/07-17/9/08	
BLV	Vanguard Long-Term Bond ETF	10/4/07-17/3/10	10/4/07-17/9/08	
BIV	Vanguard Intermediate-Term Bond ETF	10/4/07-17/3/10	10/4/07-17/9/08	
CSJ	iShares Barclays 1-3 Year Credit Bond Fund	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10
GVI	iShares Barclays Intermediate Government/Credit Bond Fund	19/3/07-17/3/10	19/3/07-17/9/08	
LQD	iShares iBoxx \$ Investment Grade Corporate Bond Fund	19/3/07-17/3/10	19/3/07-17/9/08	
TIP	iShares Barclays TIPS Bond Fund	19/3/07-17/3/10	19/3/07-17/9/08	
MBB	iShares Barclays MBS Bond Fund	16/3/07-17/3/10	16/3/07-17/9/08	

U.S. Treasury Bill Category

Ticker	ETF Name	Overall	Pre-Tsunami	Post-Tsunami
IEI	iShares Barclays 3-7 Year Treasury Bond Fund			
SHV	iShares Barclays Short Treasury Bond Fund			
SHY	iShares Barclays 1-3 Year Treasury Bond Fund	19/3/07-17/3/10	19/3/07-17/9/08	18/9/08-17/3/10
TLH	iShares Barclays 10-20 Year Treasury Bond Fund			
TLT	iShares Barclays 20+ Year Treasury Bond Fund			

Table 2. a. Annual Rate of Return; b. Annual Rate of Return; c. Annual Rate of Return; d. Annual Rate of Return; e. Annual Rate of Return; f. Annual Rate of Return.

a. Bear Market Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami (18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20
SU	61%	-33.97	-22.03	-32.89	-37.07	-0.99	-35.33	7.55	-3.58	10.89	11.32	10.33	-2.24	-56.18	-49.36	-56.01	-67.62	-26.52	-54.51
SH	27%	-7.96	-14.42	0.16	-9.28	-8.25	2.25	10.89	-9.34	4.12	-2.05	0.60	17.73	-22.01	-19.26	-10.99	-17.92	-8.29	-3.40

DOG	24%	-8.03	-5.88	0.31	-7.71	-5.01	4.31	7.25	-7.65	2.29	3.92	3.73	11.44	-19.35	-4.06	-6.27	-15.38	-2.79	-2.44
UDN	10%	2.24	3.91	2.22	1.96	2.93	4.19	6.03	8.44	1.54	-0.16	5.15	2.52	-1.26	0.80	3.50	4.16	6.85	6.07
SRS	100%	-57.13	-46.78	-32.05	-56.46	-55.60	-25.69	12.53	-37.77	-11.51	-18.40	-31.37	13.67	-82.35	-63.74	-53.37	-67.00	-27.00	-33.37
SMN	80%	-52.23	-46.41	-28.58	-41.57	-31.00	-12.29	-21.88	-26.56	-24.66	-26.99	-29.92	1.28	-70.54	-70.25	-42.52	-53.02	-4.48	-31.21
SKF	92%	-36.44	-45.52	-40.15	-43.44	-42.26	46.52	45.30	-3.16	-14.97	-10.18	-8.15	25.69	-69.42	-58.59	-54.83	-21.71	-5.07	17.57
DUG	72%	-44.74	-35.74	-29.06	-36.62	-21.23	-32.78	-27.58	-7.12	-2.97	7.56	-7.15	7.25	-56.51	-50.05	-42.60	-50.89	-14.56	-44.83

b. Latin America Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami(18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OVMA10 × 20
EWZ	47%	16.52	-5.76	9.73	17.20	27.02	-1.29	9.58	-1.39	-2.29	-8.07	5.99	6.81	21.34	-3.74	23.39	49.80	52.51	23.30
ILF	51%	12.10	-10.03	7.85	23.15	19.52	12.94	4.11	-10.28	4.11	4.52	3.22	30.14	15.76	-2.63	11.75	45.36	38.61	50.22

c. Telecommunications Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami(18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OVMA10 × 20
IXP	26%	-5.99	2.60	0.55	1.13	-2.40	5.01	-11.49	-1.81	-3.04	-1.02	-11.13	-4.97	-2.74	7.30	4.30	3.36	7.30	16.16
PBS	29%	-6.74	1.75	14.00	5.36	28.60	2.11	-24.77	-2.94	-9.54	-5.48	NA	-19.58	12.73	6.15	44.00	17.58	65.81	38.25
VOX	28%	-9.47	-19.90	-13.55	-11.17	-0.32	5.02	-20.05	-16.62	-19.38	-17.16	-5.20	-5.67	-0.46	-23.04	-7.23	-6.10	3.05	29.42

d. Consumer Staples Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami(18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OVMA10 × 20
VDC	17%	2.62	-3.77	-4.03	-5.70	3.51	0.09	4.06	-7.21	-7.59	-7.12	0.67	3.55	-0.11	-0.17	-0.30	0.04	18.28	-0.11
XLP	17%	2.28	-6.52	-9.54	0.33	-6.49	-0.50	4.16	-12.13	-10.43	-0.67	-6.08	-0.90	-0.02	-0.33	-6.19	2.09	-0.07	1.66

e. Bond Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami(18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OVMA10 × 20
HYG	17%	-5.45	-3.96	-0.42	2.40	2.22	2.09	-15.70	-6.40	-1.98	-3.91	-4.38	-1.43	0.45	6.36	6.00	11.53	9.17	13.74
GBF	7%	1.67	2.14	0.06	2.94	1.89	0.09	0.39	2.39	-1.77	2.11	1.71	-1.49	3.78	2.27	1.95	0.24	0.04	2.39
BSV	5%	2.31	-0.01	1.71	-0.48	-2.20	-0.32	2.61	-0.14	3.24	3.38	-0.25	2.28	2.13	0.23	0.35	-2.58	0.81	-0.96
BLV	12%	1.35	-1.95	-1.14	-0.51	-1.92	-1.18	-0.38	-4.71	-2.73	-2.90	-5.21	-7.68	3.08	0.85	2.29	2.58	2.96	8.79
BIV	9%	2.61	2.07	3.75	3.27	1.22	4.23	1.51	0.43	2.09	3.93	NA	4.36	4.75	3.69	5.39	2.62	1.24	5.90
CSJ	6%	1.19	1.32	-0.50	1.34	0.30	1.47	-2.09	0.12	-2.70	-0.71	-1.67	-1.98	5.38	6.13	3.88	2.52	1.90	2.95
GVI	6%	1.95	0.22	2.00	0.24	-0.10	2.64	1.18	-1.32	-0.15	-0.95	-0.45	-0.01	3.17	1.48	3.91	0.93	1.06	6.39
LQD	11%	-0.16	3.86	1.32	-9.47	-1.12	-1.89	-11.75	-4.45	-3.92	-8.71	-7.96	-9.55	12.10	6.94	6.91	-1.63	3.03	4.70
TIP	9%	1.24	-2.39	-0.31	0.57	-1.67	0.12	2.61	2.30	-0.82	2.07	-3.33	-0.89	0.76	-4.40	3.10	-0.92	2.15	4.58
MBB	4%	2.16	-2.34	0.07	0.75	2.13	0.11	1.75	-2.87	1.13	1.96	1.04	-0.19	3.23	-0.75	0.33	0.74	2.60	2.10

f. US Treasury Bill Category

Ticker	Volatility	Overall (19/03/07-17/03/10)						Pre-Tsunami (19/03/07-17/09/08)						Post-Tsunami(18/09/08-17/03/10)					
		Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OBVMA10 × 20	Buy-hold	OBV10	OBV20	OBV50	OBV100	OVMA10 × 20
IEI	6%	3.48	2.62	1.62	2.05	0.91	2.21	6.24	0.76	1.53	4.56	0.08	4.88	1.16	4.53	-1.95	-3.08	0.77	0.09
SHV	1%	0.34	-0.06	0.01	-0.26	-0.12	0.21	0.87	0.38	0.60	NA	NA	0.67	-0.17	-0.42	-0.44	-0.25	-0.19	-0.21
SHY	2%	1.28	-0.87	0.00	0.12	-0.42	0.39	3.01	-0.81	1.69	1.74	0.16	2.01	-0.22	-0.73	-1.45	-1.10	-0.28	-0.86
TLH	11%	2.48	-4.99	-0.62	-3.45	0.35	-0.45	5.78	-3.61	4.00	1.85	2.86	4.53	-0.12	-5.38	-1.75	-5.28	-1.99	-1.57
TLT	15%	0.66	-1.24	-1.55	0.33	-8.04	-1.70	6.37	4.12	2.69	0.99	-1.56	1.76	-3.86	-6.38	-2.66	-0.36	-8.97	-4.87

3. Results and Conclusions

Table 2 reports the annualized rate of return (in percent-

age) of our *OBV* trading rules. Note that the *OBVMA10* × 20 rule performs consistently well in the three periods. For Bear Market and Latin America ETFs, the trading

rules outstrip the buy-and-hold benchmark in almost all cases. Specifically, for the case of Proshares Ultrashort Financials (SKF), the *OBVMA10* \times 20 is able to achieve an annual rate of return of 47%. For the Bear Market ETFs, all the trading rules, especially *OBVMA10* \times 20, clearly dominate the buy-and-hold strategy. For ETFs in Bond, Telecommunications and Consumers Staples, our trading rules also beat the market in general. Note that the *OBV* trading rules excel in volatile markets. The higher the volatility, the better that the relative performance of the *OBV* rules. For ETFs associated with US Treasury Bills, the *OBV* trading rules fail to deliver a handsome return. For the whole sample period and pre-Tsunami period, the profits generated by the *OBV* trading rules are reasonably good. For the post-Tsunami period, our trading rules generate notably higher return than the benchmark. Overall, our results reveal that the *OBV* trading rule can beat the buy-and-hold strategy in the ETF market, especially for those ETFs with high volatility. This is in contrast to the conventional wisdom that funds should be bought and held.

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