

# ETP TRADING COSTS

---

Like any other investment fund, ETPs have trading costs. For ETPs, the total cost has four components: (a) expense ratio, (b) commission rate, (c) bid/ask spread, and (d) premium/discount. We discuss each in turn. Finally, we discuss how each cost component interacts with the others in helping choose between competing products.

## Expense ratio

All exchange-traded products have a flat annual fee rate for expenses. The *gross expense ratio (GER)*, expressed as a percent of assets under management, includes the annual *costs of operation* plus a *management fee*. The operation costs do not include the trading costs associated with portfolio rebalancing due to corporate events or changes in benchmark index composition. On occasion, however, the issuer of the ETP may offer a temporary reduction in the *GER* to attract new customers. This *fee waiver (FW)* is also expressed as a percent of assets under management and is subtracted from the gross expense ratio to determine the *net expense ratio (NER)*. Expressed differently,

$$\text{net expense ratio} = \text{gross expense ratio} - \text{fee waiver}$$

or

$$\text{NER} = \text{GER} - \text{FW}.$$

To illustrate different practices, consider the Vanguard Total Bond Market ETF (BND). In general, Vanguard does not provide temporary incentives to attract new customers. Their business model is to provide the lowest, permanent fee they can from the outset. BND is no exception. At 0.035% or 3½ basis points (bps), BND has the lowest fee among all investment-grade bond funds. Their summary prospectus indicates that of the 0.035%, 0.025% is Management Fees, and 0.010% is Other Expenses.<sup>1</sup> BlackRock's iShares Core U.S. Aggregate Bond ETF (AGG) provides a close substitute for BND's return/risk exposure. It currently has a *NER* of 0.050%. Its *GER* is 0.06%; however, it currently has a fee waiver of 0.01% until June 30, 2026.<sup>2</sup> The expense amount is computed each trading day at a rate of  $\text{NER} \times (\# \text{ of days} / 365)$  times the dollar value of AUM. On Tuesday through Friday, the number of days is 1. On Mondays, it is 3 to account for the weekend. Holidays need appropriate adjustments.

---

<sup>1</sup> Vanguard Total Bond Market ETF Summary Prospectus, April 26, 2019, page 1.

<sup>2</sup> iShares Core U.S. Aggregate Bond ETF Fact Sheet as of 12/31/2019.

## Commission rate

Commissions are the costs associated with executing the trade, are usually expressed as a dollar amount per trade, are broker-specific, and vary in the range of services provided. Executing trades by phone, for example, is likely to be more expensive than performing them online. The excellent news about commissions is that there is such intense competition among brokers to win your business that they are disappearing. Many brokerages like Charles Schwab and Fidelity are now commission-free.

## Bid/ask spread

The bid/ask spread is the difference between the quoted price at which you can buy an ETP instantaneously (i.e., the ask) and the quoted price at which you can sell an ETP instantaneously (i.e., the bid). The *bid/ask spread* is the fee the market maker charges for providing you with immediacy of exchange.

The size of the spread for any security depends on:

- a. market liquidity,
- b. inventory-holding premium,<sup>3</sup> and
- c. supply/demand.

Market liquidity is generally measured by trading volume or trading volume as a percent of the shares outstanding. The higher the turnover, the lower the spread. The inventory holding premium is the cost of the market maker taking a position in a security with low liquidity. Since he is forced to maintain the security in inventory for longer, he faces hedging costs. The longer the holding period, the greater the chance of a sizeable adverse price movement and the larger the bid/ask spread. Finally, the supply of security is fixed in the short run. Excess demand to buy will deplete the market maker's inventory, forcing him to borrow the security from someone else. The cost of borrowing the security gets impounded in the bid/ask spread.

## Premiums/discount

An ETP is at a *premium* when its market price exceeds the net asset value (i.e., the total of all the prices of the underlying holdings).<sup>4</sup> A *discount* is just the opposite. The only cost (benefit) of the premium/discount is when it changes from when the position is opened until it is closed. Slight deviations (within transaction cost bands) are expected due to supply/demand pressures. The arbitrage represented by the creation/redemption process ensures that the deviations do not become large. Deviations may also arise when the daily closing times are non-

---

<sup>3</sup> See Bollen, Smith, and Whaley (2004).

<sup>4</sup> The definition becomes tricky when considering ETNs since net asset value is not transparent and may bear little resemblance to the composition of the benchmark index. In the determination of the premium/discount, an ETN's *indicative value* is usually used.

simultaneous. For example, the Barclay Bank's iPath Series B S&P 500 VIX Short-Term Futures (VXX) has a daily indicative value computed at 3:15PM CT each day when the VIX futures market closes. The VXX itself trades in the stock market, which closes at 3:00PM. Thus, part of the observed end-of-day premium/discount is driven by VIX futures price movements after 3:00PM but before 3:15PM.

### Cost/benefit analysis for competing products

The market for ETPs is highly competitive. The reason is that new product entry barriers are low, particularly for established product structures and issuers like BlackRock, Vanguard, and State Street. Trading costs usually drive the decision between competing products. To understand how, reconsider the trading cost elements. The expense ratios are important. The commission rate is not since it applies equal force across product alternatives, and commission rates are driven to 0. Bid/ask spreads are important. Depending on the anticipated length of your holding period, they may be incurred frequently or rarely. Finally, premiums/discounts are generally irrelevant since they tend to be constant over time.

The two critical elements in the decision among competing ETPs are the expense ratio and the bid/ask spread. To model their effects, we begin with the expense ratio and develop an expression for the holding period return after expenses. Assuming no tracking error, the  $HPR_{i,T}^{After}$  of fund  $i$  is defined as

$$\begin{aligned} 1 + HPR_{i,T}^{After} &= \prod_{t=1}^T (1 - ER_i)(1 + R_{S,t}) \\ &= (1 - ER_i / 365)^T \prod_{t=1}^T (1 + R_{S,t}) \\ &= (1 - ER_i / 365)^T (1 + HPR_{S,T}^{Before}) \end{aligned} \quad (1)$$

where  $ER_i$  is the expense ratio of fund  $i$ ,  $T$  is the number of days in the holding period and  $R_{S,t}$  is the daily rate of return of the benchmark index. Note that, in this expression, the expense ratio is explicitly applied to the value of the assets each day. The holding period return before expenses  $HPR_{S,T}^{Before}$  is assumed to be the same across funds because we choose among competing products with a common return/risk profile. The *expense ratio cost per dollar invested* for fund  $i$  and a holding period of  $T$  days ( $ERC_i$ ) is

$$ERC_{i,T} = 1 - \frac{(1 + HPR_{i,T}^{After})}{(1 + HPR_{S,T}^{Before})} = 1 - \left(1 - \frac{ER_i}{365}\right)^T. \quad (2)$$

Next, we incorporate the bid/ask spread. The most common measure of spread is the relative bid/ask spread, that is, the bid/ask spread divided by the bid/ask midpoint. Unfortunately, most financial services report these figures only

to two decimal places. With high prices and low dollar spreads, the statistics become useless. Take, for example, State Street's SPY. Its current price per share is about \$300, and its spread is about a penny. The reported relative spread is 0.00 rather than its actual value of 0.000033. While this distinction seems unimportant, it has dramatic consequences for high-frequency traders. The best way to model the effects is in dollars and cents. Real-time dollar bid/ask price quotes are supplied by any number of services. If we assume that the dollar amount of the bid/ask spread is invariant through time, the *bid/ask spread cost per dollar invested* can be written

$$SPRDC_{i,T} = \frac{0.5 \times Sprd_i \times (e^{rT} + 1)}{S} \quad (3)$$

where  $S$  is the current share price. In this specification, half the bid/ask spread,  $0.5 \times Sprd_i$  is incurred at the time of purchase (sale), and the other half at the time of sale (purchase). Gathering both costs at the end of the holding period gives  $0.5 \times Sprd_i \times (e^{rT} + 1)$ . With competing ETFs on the same benchmark, the lowest-cost fund is the one with the least total cost where  $TC_{i,T} = ERC_{i,T} + SPRDC_{i,T}$ .

To illustrate our theoretical analysis framework, consider the three most popular ETF products benchmarked to the S&P 500 index. Table 1 shows some of their attributes as of January 2, 2020. Regarding assets under management, SPY is the largest, undoubtedly enjoying its first-mover advantage. SPY was launched in January 1993. BlackRock launched IVV more than seven years later, and Vanguard took over ten years to launch the VOO. Of the three ETFs, SPY has the highest expense ratio at 9.45 basis points. IVV has an expense ratio of 4 basis points, and VOO has 3. The most interesting feature in the table is turnover (or, equivalently, the holding period). Turnover is the dollar trading volume divided by the assets under management. The value of 6.12% for SPY means that 6.12% of the shares outstanding trading each day on average. The inverse of this number is the average number of days shares of SPY are held. At 16.4 days, its holding period is relatively short. In contrast, the typical holding period for IVV and VOO is about  $\frac{1}{2}$  year. In other words, SPY is used as a day-trading vehicle; buy-and-hold investors use IVV and VOO more.

---

**Table 1: Expense ratios, bid/ask spreads, and turnover for SPY, IVV and VOO**

---

Symbol	Inception	ER	AUM in \$B	Volume in M	Price	Bid/ask spread	Turnover	Holding period	Growth in AUM
SPY	19930122	0.000945	307.39	58.41	321.86	0.01	6.12%	16.4	13.1%
IVV	20000515	0.0004	201.31	3.46	323.24	0.02	0.56%	180.0	8.5%
VOO	20100909	0.0003	130.59	2.40	295.80	0.03	0.54%	183.7	7.4%

---

We now address what our modeling of trading costs suggests. To do so, we use the expense ratios, prices per share, and bid/ask spreads for the competing ETFs represented in Table 1. Based upon that information, we compute numerical values for (a) the expense ratio cost per dollar of investment by holding period,  $ERC_{i,T}$  (eqn. 2), (b) the bid/ask spread cost per dollar of investment,  $SPRDC_{i,T}$  (eqn. 3), and (c) the total cost per dollar of investment as of the end of December 2019. At that time, the 90-day T-bill rate was about 1.5%. Table 2 contains the results. The table shows that there is no economic reason to trade SPY from a trading cost standpoint if your holding period is longer than one day. Even at one day, when the effect of the lower bid/ask should be strongest, its effect is pale by comparison to the holding period cost of the expense ratio. SPY is preferred only by day traders who are in and out on the same day, in which case they avoid the end-of-day expense ratio levy. For the shortest holding periods reported in the table, IVV is the most economical. As the holding increases in number of days, VOO becomes more economical because the effects of its lower expense ratio begin to dominate. For holding periods of 15 days and beyond, VOO is the ETF of choice from a trading cost standpoint.

Interestingly, by 182 days ( $\frac{1}{2}$  year), more than 4.6% of your ETF value has been drawn away by trading expenses. By the end of the year, the figure is over 9.0%. These compared to 0.16% and 0.30% for VOO.

**Table 2: Computation of minimum trading cost S&P 500 ETF by holding period**

Risk-free rate	1.50%								
ETFs	SPY	IVV	VOO						
Price	307.39	323.24	295.80						
Expense ratio	0.0945	0.0040	0.0030						
Bid/ask spread	0.01	0.02	0.03						
Holding period in days	Expense ratio cost per dollar			Bid/ask spread cost per dollar			Total cost per dollar		
	SPY	IVV	VOO	SPY	IVV	VOO	SPY	IVV	VOO
1	0.000259	0.000011	0.000008	0.000033	0.000062	0.000101	0.000291	0.000073	0.000110
2	0.000518	0.000022	0.000016	0.000033	0.000062	0.000101	0.000550	0.000084	0.000118
3	0.000777	0.000033	0.000025	0.000033	0.000062	0.000101	0.000809	0.000095	0.000126
4	0.001035	0.000044	0.000033	0.000033	0.000062	0.000101	0.001068	0.000106	0.000134
5	0.001294	0.000055	0.000041	0.000033	0.000062	0.000101	0.001326	0.000117	0.000143
6	0.001552	0.000066	0.000049	0.000033	0.000062	0.000101	0.001585	0.000128	0.000151
7	0.001811	0.000077	0.000058	0.000033	0.000062	0.000101	0.001843	0.000139	0.000159
8	0.002069	0.000088	0.000066	0.000033	0.000062	0.000101	0.002102	0.000150	0.000167
9	0.002328	0.000099	0.000074	0.000033	0.000062	0.000101	0.002360	0.000161	0.000175
10	0.002586	0.000110	0.000082	0.000033	0.000062	0.000101	0.002619	0.000171	0.000184
11	0.002844	0.000121	0.000090	0.000033	0.000062	0.000101	0.002877	0.000182	0.000192
12	0.003102	0.000131	0.000099	0.000033	0.000062	0.000101	0.003135	0.000193	0.000200
13	0.003361	0.000142	0.000107	0.000033	0.000062	0.000101	0.003393	0.000204	0.000208
14	0.003619	0.000153	0.000115	0.000033	0.000062	0.000101	0.003651	0.000215	0.000217
15	0.003877	0.000164	0.000123	0.000033	0.000062	0.000101	0.003909	0.000226	0.000225
16	0.004134	0.000175	0.000131	0.000033	0.000062	0.000101	0.004167	0.000237	0.000233
17	0.004392	0.000186	0.000140	0.000033	0.000062	0.000101	0.004425	0.000248	0.000241
18	0.004650	0.000197	0.000148	0.000033	0.000062	0.000101	0.004683	0.000259	0.000249
19	0.004908	0.000208	0.000156	0.000033	0.000062	0.000101	0.004940	0.000270	0.000258
20	0.005165	0.000219	0.000164	0.000033	0.000062	0.000101	0.005198	0.000281	0.000266
182	0.046033	0.001993	0.001495	0.000033	0.000062	0.000102	0.046066	0.002055	0.001597
365	0.090183	0.003992	0.002996	0.000033	0.000062	0.000102	0.090216	0.004054	0.003098

## References

Bollen, Nicolas P.B., Tom Smith and Robert E. Whaley, 2004, Modeling the bid/ask spread: Measuring the inventory-holding premium, *Journal of Financial Economics* 72, 97-141.