Advanced ETF Analytics

Methodology Paper
Version 3.0

Estimated Holding Cost

Description

Estimated Holding Cost measures the realized performance of an ETF manager relative to the benchmark index after all expenses both disclosed and undisclosed. This calculation measures predictable returns of the portfolio net asset value relative to the underlying index, isolating the information in past performance data predictive of how a fund will perform against its index in the future. The largest component is likely to be the fund's expense ratio and like an expense ratio, the estimated holding cost is expected to be a positive number which represents the extent to which a fund has underperformed its benchmark. A smaller or even negative estimated holding cost shows that a manager is doing a better job finding the lowest cost ways to replicate the benchmark index.

Calculation

The calculation of Estimated Holding Cost differs depending on whether a fund attempts to maintain a beta of one against its benchmark index, or whether it provides leveraged or inverse exposure.

For beta-one products (Weighting = 100), use the following calculation:

For each of the past twenty trading days, calculate the one-year trailing total return in USD up to that date for an ETF's NAV return series and its respective benchmark index. Calculate each of these returns as a decimal. E.g. a 11.36% return should be calculated as 0.1136.

Let $\mathbf{y}_{N,i}$ be the one-year trailing total return in USD for the fund NAV up to i trading days ago. For example, for a calculation on February 23, 2011 in the United States ETF market, $\mathbf{y}_{N,7}$ would be the one-year total NAV return for an ETF from February 12, 2010 through February 11, 2011 (precisely seven trading days before February 23, 2011). Let $\mathbf{y}_{B,i}$ be the comparable one-year trailing total return in USD for the fund's benchmark index up to i trading days ago.

For each value of i from 1 through 20, calculate:
$(1 + \mathbf{y}_{N,i}) / (1+\mathbf{y}_{B,i})$

Take the geometric mean of these twenty quotients to produce $\mathbf{q}_0$, a ratio form of the smoothed annualized estimated holding cost. Transform q into the percentage point difference form of Estimated Holding Cost for presentation in products.

Estimated Holding Cost $= 100 \cdot (1 - \mathbf{q}_0)$

For all other funds (Weighting ã 100), use the following calculation:

Let $\mathbf{r_{N,i}}$ be the NAV return from i trading days ago for a given ETF. Let $\mathbf{r_{B,i}}$ be the corresponding primary benchmark index return from i trading days ago. Pull 271 trading days of daily returns for each return series, convert all daily returns into USD, and store the returns as decimal values (11.36% return = 0.1136).

Calculate holding cost estimates $\mathbf{q_i}$ in ratio form using rolling 252-day periods (for i = 1 through 20):

$$\mathbf{q_i} = \frac{\prod_{j=i}^{i+251}[1+r_{N,j}]}{\prod_{j=i}^{i+251}[1+(w/100)\cdot r_{B,j}]}$$

Where **w** is the weighting of the ETF on its benchmark index, a measure of leverage given in percentage points of intended index participation. Each $\mathbf{q_i}$ represents an individual point-to-point estimate of the annual cost of holding the fund relative to its benchmark index.

Take the geometric mean of these twenty quotients ($\mathbf{q_i}$ for i = 1 through 20) to produce $\mathbf{q_0}$, a ratio form of the smoothed annualized estimated holding cost. Transform $\mathbf{q_0}$ into the percentage point difference form of Estimated Holding Cost for presentation in products.

Estimated Holding Cost = $100 \cdot (1 - \mathbf{q_0})$

Tracking Volatility

Description

Tracking Volatility is a measure of the day-to-day random variation in a fund portfolio versus its benchmark index. This data point seeks to isolate the ability of the portfolio managers to track the index, ignoring the confounding effects of ETF liquidity on market prices, so it compares NAV returns rather than market returns to the underlying benchmark. The statistical model includes a lagged error term to account for stale prices that can cause spurious daily pricing differences against many fixed-income and foreign equity indices. Lower tracking error shows better replication of the benchmark index by the ETF manager, which implies the ETF hew closer to its predicted future performance versus the index.

Calculation

Let $\mathbf{r_{N,i}}$ be the NAV return from i trading days ago for a given ETF. Let $\mathbf{r_{B,i}}$ be the corresponding primary benchmark index return from i trading days ago. Pull 250 trading days of daily returns for each return series, convert all returns into USD form, and store the returns as decimal values (11.36% return = 11.36).

Use the $\mathbf{r_{B,i}}$ as an explanatory variable in an MA(1) regression fitted to the $\mathbf{r_{N,i}}$ values, fitting the following model to produce a maximum likelihood estimation:

$r_{N,i} = \beta_0 + \beta_1 \cdot r_{B,i} + \beta_2 \cdot \varepsilon_{i-1} + \varepsilon_i$

Call the standard error of this regression $\boldsymbol{\sigma_\varepsilon}$.

Tracking Volatility = $\sqrt{250} \cdot \boldsymbol{\sigma_\varepsilon}$

Market Impact Cost

Description

Market Impact Cost, along with the bid-ask ratio and volume measures, is a measure of the liquidity of an ETF. Less liquid securities are more thinly traded, and a single large trade can move their prices considerably. Morningstar's market impact measure is an estimate of the basis point change in an ETF's price caused by a $100,000 trade regardless of the base currency of the fund. A lower market impact implies the ETF is more liquid, but the actual size of price movements due to a single trade may vary considerably from this estimate depending on market activity.

The market impact cost for an ETF incorporates the information of the bid-ask spread, and even the depth of market order books, by measuring the volatility of market prices around the true portfolio value. Our market impact calculation standardizes that volatility to a basis point value from a $100,000 trade through the common assumption that trades in the ETF are sequentially independent, and return variance caused by the trade increases in linear proportion with the dollar size of each trade.

Calculation

Let $\mathbf{r_{N,i}}$ be the NAV return from i trading days ago for a given ETF. Let $\mathbf{r_{M,i}}$ be the corresponding total market price return from i trading days ago. Pull 250 trading days of daily returns for each return series, convert all returns into USD, and store the returns as percentage point values (11.36% return = 11.36).

Also pull the market closing price ($\mathbf{p_{M,i}}$) and NAV ($\mathbf{p_{N,i}}$) for each of the past 251 trading days and calculate the premium/discount for each day in percentage points:

$$\mathbf{PD_i} = 100 \cdot (\mathbf{p_{M,i}} / \mathbf{p_{N,i}} - 1)$$

Then regress the daily market returns on the same-day NAV return and the previous day's closing premium/discount using an ordinary least-squares regression to fit the following model:

$$r_{M,i} = \beta_0 + \beta_1 \cdot r_{N,i} + \beta_2 \cdot PD_{i-1} + \varepsilon_i$$

Call the standard error of this regression $\boldsymbol{\sigma_\varepsilon}$.

To normalize the volatility of market prices around NAV for a $100,000 trade, calculate the average daily dollar volume over the past 250 trading days:

$$\mathbf{V_d} = {}^1/_{250} \cdot \sum_{i=1}^{250} V_i \cdot P_i$$

Where $\mathbf{V_i}$ is the share trading volume for the ETF i trading days ago, $\mathbf{P_i}$ is the closing market price for the ETF i trading days ago in USD, and $\mathbf{V_d}$ is the average daily dollar trading volume of the ETF.

Market Impact Cost = $\sigma_{\varepsilon} \cdot \sqrt{\frac{10{,}000{,}000}{V_d}}$

Portfolio Concentration

Description

Portfolio Concentration measures the idiosyncratic (non-market) risk taken on by an ETF. Since an efficient market does not compensate higher idiosyncratic risk with higher returns, a lower portfolio concentration is better for investors seeking to avoid security-specific and sector-specific risks. Investors looking to make a tactical call on a specific industry or sector might seek higher concentration, as that suggests an ETF portfolio has higher exposure to sector-specific return factors.

This measure only currently applies to U.S. equity, international equity, and fixed-income ETFs based in the United States, as those three broad asset classes have diversified return factors generally agreed upon in the academic finance literature. Equity ETFs use proxies for U.S. or global market, size, and value risk factors to separate diversified, systemic portfolio risk from idiosyncratic risk. Fixed-income ETFs use proxies for aggregate market, credit, and duration risk factors to separate diversified, systemic portfolio risk from idiosyncratic risk.

Calculation

Portfolio Concentration is calculated by a linear regression of the ETF's daily NAV returns on the daily returns of three risk factors calculated from Morningstar indexes. Portfolio Concentration is the standard deviation of the error term in that regression.

To calculate Portfolio Concentration for US equity funds, pull daily returns for the past 250 trading days for the ETF and the following indexes: Morningstar US Market TR, Morningstar Large Cap TR, Morningstar Small Cap TR, Morningstar US Value TR and Morningstar US Growth TR. Store the returns as percentage point values (11.36% return = 11.36).

For the trading day i days ago, let $\mathbf{r_{N,i}}$ be the return on the ETF's NAV that day, $\mathbf{r_{B,i}}$ be the return on the Morningstar US Market TR index, $\mathbf{r_{S,i}}$ be the return on the Morningstar Small Cap TR index **minus** the return on the Morningstar Large Cap TR index, and $\mathbf{r_{V,i}}$ be the return on the Morningstar US Value TR index **minus** the return on the Morningstar US Growth TR index.

Regress the daily NAV returns for the ETF on each of the risk factor returns using an ordinary least-squares regression to fit the following model:

$$r_{N,i} = \beta_0 + \beta_1 \cdot r_{B,i} + \beta_2 \cdot r_{S,i} + \beta_3 \cdot r_{V,i} + \varepsilon_i$$

Call the standard error of this regression $\boldsymbol{\sigma_\varepsilon}$.

Portfolio Concentration = $\sqrt{250} \cdot \boldsymbol{\sigma_\varepsilon}$

To adjust this methodology for Fixed-Income ETFs:

Replace **Morningstar US Market TR** index with **BarCap US Aggregate Bond TR**
Replace **Morningstar Large Cap TR** index with **BarCap US Aggregate 1-3 Yr TR**
Replace **Morningstar Small Cap TR** index with **BarCap US Aggregate 10+ Yr TR**
Replace **Morningstar US Value TR** index with **BarCap US Corporate High Yield TR**
Replace **Morningstar US Growth TR** index with **BarCap US Government TR**

To adjust this methodology for International Equity ETFs:

Replace **Morningstar US Market TR** index with **MSCI AC World Ex USA IMI GR**
Replace **Morningstar Large Cap TR** index with **MSCI AC World Ex USA GR**
Replace **Morningstar Small Cap TR** index with **MSCI AC World Ex USA Small GR**
Replace **Morningstar US Value TR** index with **MSCI AC World Ex USA Value GR**
Replace **Morningstar US Growth TR** index with **MSCI AC World Ex USA Growth GR**