

The ETF Portfolio Strategist

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Benchmark and Risk/Return Definitions

Strategy Benchmarks

US.60.40: US stocks (VTI)/bonds (BND) portfolio, rebalanced every Dec. 31 to a 60%/40% allocation.

GMI: an unmanaged global portfolio that holds the major asset classes in market-value weights. GMI represents a broadly defined opportunity set for conventional investing strategies and is presented as a passive benchmark that's theoretically the optimal strategy for the average investor with an infinite time horizon.

| Major Asset Classes: Fund Proxies | | | |
|-----------------------------------|-------------|--------------------------------------|--|
| Stocks | US | US equities | Vanguard Total Stock Market (VTI) |
| | Foreign | Foreign devlp'd mkts equities | Vanguard FTSE Developed Markets (VEA) |
| | | Emerging markets equities | Vanguard FTSE Emerging Markets (VWO) |
| Bonds | US | US investment grade bonds | Vanguard Total Bond Market (BND) |
| | | US inflation-linked Treasuries | iShares TIPS Bond (TIP) |
| | | US junk bonds | SPDR Bloomberg High Yield Bond (JNK) |
| | Foreign | Foreign devlp'd mkts gov't bonds | SPDR Bloomberg Int'l Treasury (BWX) |
| | | Emerging markets gov't bonds | VanEck Vectors JPM EMLC Bonds (EMLC) |
| | | Foreign gov't inflation-linked bonds | SPDR Citi Int'l Gov't Infl-Indexed Bonds (WIP) |
| | | Foreign invest-grade corporates | Invesco Int'l Corporate Bonds (PICB) |
| | | Foreign junk bonds | VanEck Vectors Int'l High Yield Bond (IHY) |
| Alts | Commodities | Commodities | WT Continuous Commodity (GCC) |
| | Real Estate | US REITs | Vanguard US Real Estate (VNQ) |
| | | Foreign REITs/real estate | Vanguard Global ex-US Real Estate (VNQI) |

G.B5: a twist on GMI that reduces fund holdings to five broadly defined funds that target global exposure to stocks (VT), US bonds (BND), international bonds ex-US (BNDX), global real estate (REET) and commodities (GCC). Target weights: 60% stocks, 15% US bonds, 15% international bonds ex-US (BNDX), 5% global real estate and 5% commodities. The overall asset allocation is 60% stocks, 30% bonds and 10% alternatives. The portfolio is rebalanced every Dec. 31.

| Global Beta 5 (G.B5) | | | |
|----------------------|-----|---------|--|
| Stocks | 60% | Global | Vanguard Total World Stock Market (VT) |
| | | | |
| Bonds | 15% | US | Vanguard Total Bond Market (BND) |
| | 15% | Foreign | Vanguard Total International Bond (BNDX) |
| Alts | 5% | Global | Wisdom Tree Continuous Commodity (GCC) |
| | 5% | | iShares Global REIT ETF (REET) |

G.B5.ew: an equal-weighted version of G.B5, targeting 25% stocks (VT), 25% real estate/REITs (REET), 25% commodities (GCC) and 25% in bonds (split equally between BND and BNDX). The portfolio is rebalanced every Dec. 31 to the equal-weight targets.

G.B16: an expanded version of G.B5 via 16 ETFs that slice and dice the world’s major asset classes into a more granular opportunity set – 16 betas in all. The overall allocation matches G.B5 weights: 60% stocks, 30% bonds, 5% real estate shares and 5% commodities. The portfolio is rebalanced every Dec. 31.

| Global Beta 16 (G.B16) | | | | | | |
|------------------------|-----|-------------|---------------|---------------------|--|--|
| Stocks | 60% | US | 30% | Large cap | 25% | Vanguard Total Stock Market (VTI) |
| | | | | Small Cap | 5% | iShares Core S&P Small-Cap (IJR) |
| | | Foreign | 30% | Europe | 10% | Vanguard FTSE Europe (VGI) |
| | | | | Asia ex-Japan | 10% | iShares MSCI All Country Asia ex Japan (AAJ) |
| | | | | Japan | 5.0% | iShares MSCI Japan ETF (EWJ) |
| | | | | Latin America | 2.5% | iShares Latin America 40 (ILF) |
| | | | | Africa | 2.5% | VanEck Vectors Africa Index ETF (AFK) |
| | | | | | | |
| Bonds | 30% | US | 15% | US Government | 5% | iShares 7-10 Year Treasury Bond (IEF) |
| | | | | US Corp (inv grade) | 5% | iShares iBoxx Invest. Grade Corporate Bond (LQD) |
| | | | | US Junk | 5% | SPDR Bloomberg Barclays High Yield Bond (JNK) |
| | | Foreign | 15% | Foreign Government | 5% | SPDR Bloomberg Barclays Int'l Treasury Bond (BWX) |
| | | | | Foreign Junk | 5% | VanEck Vectors Int'l High Yield Bond (IHY) |
| | | | | Emerging Markets | 5% | VanEck Vectors JP Morgan EM Local Currency Bond (EMLC) |
| | | | | | | |
| Alts | 10% | Commodities | Commodities | 5% | Wisdom Tree Continuous Commodity (GCC) | |
| | | Real Estate | US REITs | 2.5% | Vanguard Real Estate (VNQ) | |
| | | | Foreign REITs | 2.5% | Vanguard Global ex-U.S. Real Estate (VNQI) | |

Active Risk-Management Strategy Benchmarks

A set of portfolio strategies using the G.B16 opportunity set (see table above) with relatively aggressive risk-management techniques applies. The goal is to offer some perspective on how various risk-management strategies evolve in changing market conditions relative to the mostly passive G.B16 portfolio benchmark.

G.B16.MOM: a proprietary strategy that uses price momentum as a risk-management tool. At the end of each month, each fund’s 10-month average (based on month-end prices) is calculated. If the current month-end price is above the 10-month average, the ETF position is risk-on. (*Note: 10-month average is based on a weighted moving average (WMA), which assigns greater weights to more recent data. This is similar to an exponential moving average (EMA) except that WMA, unlike EMA, only uses data within the rolling window – 10 months in this case.*) If the current month-end price equals or is below the 10-month average, the position is risk-off and the allocation for the ETF is moved to a “safe” asset: iShares Short Treasury Bond (SHV), a cash proxy. The risk assets are the 16 funds in G.B16 (see table above). Each fund’s allocation (which switches between a risk and risk-off asset per the rules above) is rebalanced to the target weights indicated for G.B16 every Dec. 31 (see table above). For purposes of rebalancing, risk signals are calculated after the close of each month-end’s trading and any fund changes are executed at the open of the following trading day.

G.B16.MDD: a proprietary strategy that uses drawdown as a risk-management tool – managed drawdown (MDD). If current drawdown falls below the 50th percentile (based on a rolling 50-day window), a risk-off signal is issued. A second filter applies before any tactical trading takes place: If the risk-off signal persists for each of the last two trading days in a given week, the risk asset is sold at the open on the first trading day of the next week and the proceeds are moved to the “safe” asset: iShares Short Treasury Bond (SHV), a cash proxy. Any trading events are based on prices at the open of a trading week from signals issued at the previous week’s close. The risk assets are the 16 funds in G.B16. Each fund’s allocation (which switches between a risk and risk-off asset) is rebalanced to the target weights indicated for G.B16 every Dec. 31 (see table above).

G.B16.MVOL: a proprietary strategy that uses volatility (standard deviation) as a risk-management tool – managed volatility (MVOL). If return volatility (based on the trailing 10-day window) rises above the 99th percentile

(calculated over the rolling 100-day period), a risk-off signal is triggered. A second filter applies before any tactical trading takes place: If the risk-off signal persists for each of the last two trading days in a given week, the risk asset is sold at the open on the first trading day of the next week and the proceeds are moved to the “safe” asset: iShares Short Treasury Bond (SHV), a cash proxy. Any trading events are based on prices at the open of a trading week from signals issued at the previous week’s close. The risk assets are the 16 funds in G.B16. Each fund’s allocation (which switches between a risk and risk-off asset) is rebalanced to the target weights indicated for G.B16 every Dec. 31 (see table above).

Risk and Return Metrics

Returns (1 wk ret %, YTD ret %, 1 yr ret %, 3 yr ret %, 5 yr ret %)

Total returns. Note: 3-year and 5-year performances are based on annualized results using daily prices

Note: ETFs are ranked by 5-year return within their category (US equities, foreign bonds, etc.)

Volatility (5yr Vol)

Trailing 5-year annualized standard deviation based on daily returns

Sharpe ratio¹ (5yr SR)

Trailing 5-year annualized Sharpe ratio (assuming a constant 0% risk-free rate) based on daily returns

Sortino ratio² (5yr SR)

Trailing 5-year annualized Sortino ratio (assuming a constant 0% minimum acceptable return) based on daily returns

Maximum Drawdown³ (Max DD)

Maximum drawdown for the trailing 5-year period

Current Drawdown (Curr DD)

Current drawdown

Momentum (MOM)

A proprietary measure of momentum strength/weakness, ranging from 0 (upside momentum is nil) to 100 (highest level of momentum strength). Ranking is based on the average of ten signals via moving averages and trailing return:

1. 50-day simple moving average
2. 100-day simple moving average
3. 200-day simple moving average
4. Ratio of 10-day simple moving average to 50-day simple moving average
5. Ratio of 50-day simple moving average to 100-day simple moving
6. Ratio of 50-day simple moving average to 200-day simple moving
7. Ratio of 100-day simple moving average to 200-day simple moving
8. Trailing 3-month return (63 trading days)
9. Trailing 6-month return (126 trading days)
10. Trailing 12-month return (252 trading days)

¹ Sharpe ratio quantifies the return per unit of risk (standard deviation) and so higher (lower) values equate with higher (lower) risk-adjusted return.

² Sortino ratio quantifies the return per unit of risk (downside semivariance) and so higher (lower) values equate with higher (lower) risk-adjusted return.

³ The maximum peak-to-trough decline incurred during the most recent trailing 5-year period.

The strongest momentum readings (90 to 100) are highlighted in green. The weakest momentum readings (0 to 10) are highlighted in salmon.

Short-term volatility risk (VOL.st)

A proprietary measure of the short-term (st) volatility outlook (standard deviation of daily returns). The metric signals relatively high risk when the trailing 10-day vol rises above the 99th percentile of vol on a rolling 100-day period. Higher (lower) values equate with higher (lower) risk. The values with the 3-highest risk readings are highlighted in salmon. The 3-lowest risk readings are highlighted in green. Note: when several extreme values are equal, there may be more than 3 highlights. A relatively high risk reading can be considered an early warning for the ETF's near-term outlook. *Note: for the strategy benchmark tables, only the highest- and lowest-risk numbers are highlighted for VOL.st.*

Short-term drawdown risk (DD.risk)

A proprietary measure of current drawdown cited in relative terms vis-à-vis recent history. When the current drawdown falls below the 50th percentile (based on the trailing 50-day window), drawdown risk is considered to be relatively elevated. Higher (lower) values equate with lower (higher) risk. The values with the 3-highest risk readings are highlighted in green. The 3-lowest risk readings are highlighted in salmon. Note: when several extreme values are equal, there may be more than 3 highlights. A relatively high risk reading can be considered an early warning for the ETF's outlook. *Note: for the strategy benchmark tables, only the highest- and lowest-risk numbers are highlighted for DD.risk.*

Valuation Risk (VAL)

A proprietary measure that calculates the percentile of the 5-year return relative to history. This is a proxy for the value factor. Higher numbers equate with higher 5-year returns and, as such, can be seen as indications of anti-value conditions – i.e., relatively high-priced ETFs. Note that the 5-year returns start in 2019 (calculated with price data beginning in 2014) and so the percentile rank reflects the current 5-year return in the context of that start date. Note, too, that the 5-year returns are calculated based on monthly (month-end) prices and reflect total returns. For data calculated intra-month in the current month, the latest daily price is used as a proxy for the month-end data. VAL numbers range from 1 to 99. A 99 number indicates that the current 5-year return is at the highest level relative to the return history; a reading of 1 indicates the lowest 5-year return. The highest readings (90 to 99) are highlighted in salmon and suggest a relatively high valuation. By contrast, the lowest readings (1 to 10) are highlighted in green and indicate a relatively low valuation, which may be an indication of an undervalued asset. Note that highlights may not always be indicated if numbers aren't in the extreme range (high or low).