

## ETF Risk Model

### The Four Risk Factors

We use four broad risk factors to measure and control those risks that ETFs tend to share in common:

- Stock market risk (MKT), as measured by the S&P 500 Index
- Interest rate risk (LTB), as measured by the 10 Year Treasury Benchmark Index
- Currency risk (DLR), as measured by the U.S. Dollar Index
- Commodity risk (OIL), as measured by the West Texas Intermediate Crude Oil Index

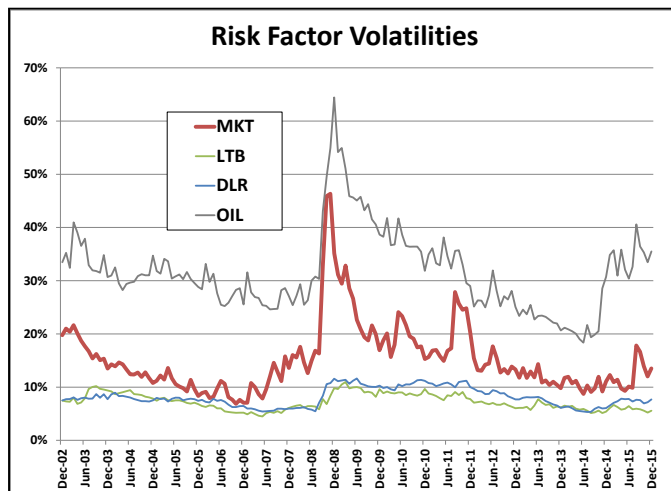
We measure the sensitivity of each ETF to these four risk factors using exponentially-weighted multiple regression analysis. The exponential weighting helps make the calculations more sensitive to changes, and thus more forward-looking.

### Risk Factor Historical Volatility and Correlation

The point of measuring the sensitivities of ETFs to the four risk factors is to construct portfolios that have low downside volatility. The amount of risk that an ETF's risk factor sensitivity will contribute to overall portfolio risk depends upon two statistical characteristics:

- Volatility—the amount of variability of the risk factor (measured by standard deviation)
- Correlation—the degree to which the risk factor moves in tandem with other risk factors

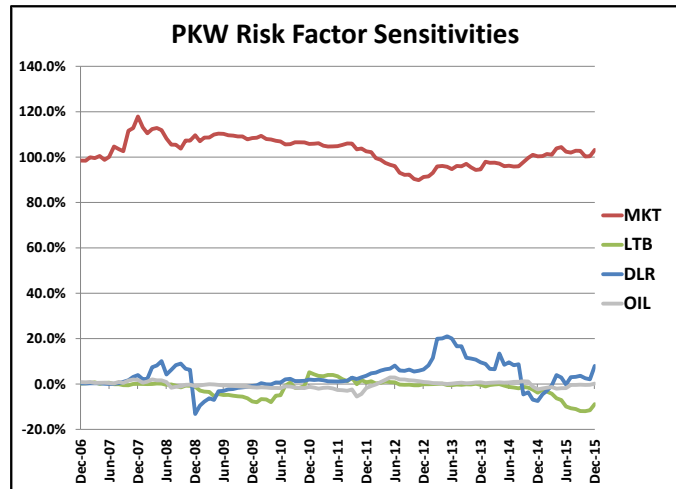
Risk factor volatility tends to follow a well-documented pattern—during normal times it bounces around its historic average range and during times of stress it spikes upward and then slowly diminishes back down towards the norm. Factor volatility does not spike downward, only upward. (See graph at right.) This pattern means that next month's factor volatility (as measured by daily standard deviation of return) will tend to be highly correlated to this month's factor volatility.



When volatilities spike upward, as they did in 2008, we must reduce the amount of exposure to risk in order to maintain a reasonably stable level of overall risk in the portfolio. We do not try to anticipate changes in the level of risk, we merely respond to changes when they occur.

### Residual Return

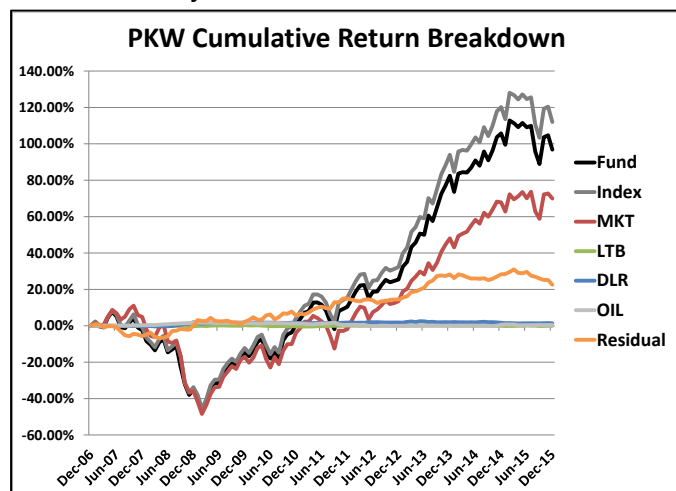
Let's look an example of how we use the ETF Risk Model to analyze the risk of an ETF. PowerShares Buyback Achievers ETF (PKW) is an ETF in our Alternative ETF universe. It is a "factor portfolio," in that it is designed to provide concentrated exposure to a factor, in this case, companies that have had a net share buyback of 5% or more within the last 12 months. Since it is a U.S. equity ETF, its only important risk is equity market sensitivity (MKT), which has tended to hover close to 100% (red line at right).



Volatility forecasts for the four risk factors are a blend of 60-day daily trailing volatility and 36-month monthly volatility. Both are exponentially-weighted to give more weight to recent experience. Risk factor correlations are based upon the exponentially-weighted 36-month history. Penalties for systematic and residual (unsystematic) volatility are subtracted from the expected return forecasts for each ETF as an important component of the utility calculation upon which ETF selection and weighting are based.

Using the historical risk factor sensitivities of PKW, and the historical actual returns of the risk factors, allows us to calculate that portion of PKW's return that was due to risk factors. Return not due to risk sensitivities we call "residual return." By construction, it is uncorrelated to risk, and is therefore a very attractive source of return. Our objective is to maximize residual return while also earning risk-based return when we believe that the return/risk tradeoff is favorable.

The graph at right disaggregates PKW's historical return into its component parts. PKW has historically generated an impressive amount of residual return (orange line at right) since its launch at the end of 2006—an average of 2.35% per year. It is debatable whether this is evidence of a market inefficiency ("alpha") or compensation for some sort



of unusual time-varying risk (“alternative beta”). Either way, our objective is to garner as much residual return as we can, since by construction residual return is uncorrelated with all four risk factors, including stock and bond market risks.

Our ETF Risk Model helps us separate risk-related return from residual return. The historical residual returns of an ETF are the raw material for the factors in our ETF Return Model.

### **Secondary Risk Factors**

In addition to the four primary risk factors described above, we also carefully monitor 12 other systematic risk dimensions that tend to mostly affect equity ETFs:

- Size risk (SMB) – small minus big
- Style risk (VMG) – value minus growth
- Momentum risk (MOM)
- Credit risk (CDT)
- Quality risk (QMJ) – quality minus junk
- Low beta risk (BAB) – betting against beta
- Volatility risk (VIX)
- Emerging market risk (EMD) – emerging minus developed
- International equity risk (XUS)
- European equity risk (EMU)
- Asia Pacific equity risk (PAC)
- Latin American equity risk (LAT)

### **Other Risk Considerations**

Individual ETF position sizes are limited to no more than 10%, and typically are much lower. The average position size is 4%-5%. Because each ETF is itself a portfolio of many individual securities, *security-specific risk* is largely diversified away.

We go to some lengths to ensure that each of the ETFs in our three universes captures a *unique investment niche* of some sort. Consequently, overlapping risk exposures are minimal. Country-specific ETFs within a single region are not strictly limited, but regional concentrations are monitored using the secondary risk factors mentioned above. Sector and industry ETFs are limited to three within a given sector, which means that a single sector would be no more than about 25% of the portfolio, and typically much less. Concentrations of equity related and fixed-income related ETFs are monitored using the four primary risk factors, and are controlled through the use of hedging positions.

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