FROM THE CAPITAL ASSET PRICING MODEL TO THE CORRELATION PRICING MODEL

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In the 1990s, when William Sharpe won the Nobel Memorial Prize for creating the capital asset pricing model (CAPM), the approach was an elegant way to break down stock returns to factors. CAPM is a single-factor model that links stock returns proportionally to their risk premiums. In other words, investors should adjust stock prices to a level that results in returns that proportionately compensate for the risk of owning those stocks.

CAPM is very simplistic in nature and does not account for other risk or return premiums. This is where the Fama-French three-factor model later expanded CAPM by trying to explain stock returns using two additional factors (size and value). Since then, additional factors such as momentum and quality (profitability) have been proposed. Thus far, these additional factors tend to be characteristics of individual stocks.

As pioneers of smart beta—or, as WisdomTree prefers to call it, modern alpha—this company continuously researches existing and new factors. I have been writing about stock correlations acting as a precursor to heightened volatility. In my analysis below, I explain why correlations could be a key factor for persistent return premiums and information on market cycles.

Correlation Curves

Investors are familiar with term structure of interest rates—the yield curve. Each point on a curve represents an interest rate corresponding to a fixed duration of time plotted on the x-axis on a curve.

A similar term structure could be plotted for average correlations for a given equity market. That is, each point of the curve would be the average of pairwise correlations between all stocks in an equity market for the corresponding trail back window of data on the x-axis.

Unlike interest rate term structures—where as you progressively go out, yields should be mostly higher due to a longer forward outlook and inflation expectations—our correlation curve should usually be flat. This is because in markets lacking systematic risk, the only difference between the calculation of near-term correlations (say, one month or three months) and far terms (say, 24 or 36 months) is simply additional trailing daily data. These average correlation numbers for longer windows should not be statistically different.

However, assets tend to be highly correlated during market corrections, so if there is a buildup of systematic risk, it usually manifests itself as near-term correlation values spiking up. This is evident in the table below, showing all three major financial crises over the last two decades: near-term correlations were higher than far-term correlations, causing the curve for S&P 500 stocks to follow what is known in the futures curve market as "backwardation."

If we exclude these crisis periods, the correlation curve was perfectly flat across the time periods shown. Spiking short-

term correlations can thus be one warning sign of challenging times ahead.

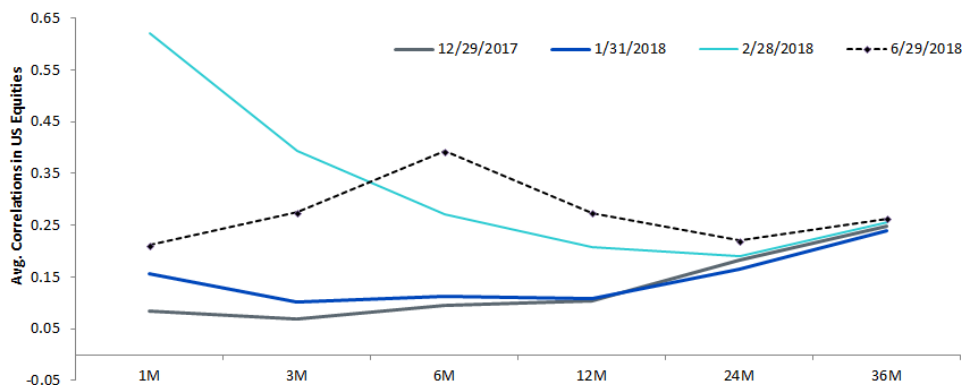|	Dates	Market Correction	Avg. Trailing Correlations for S&P 500 Stocks During Respective Periods					
			1 M	3 M	6 M	12 M	24 M	36 M
Asian Crisis	07/31/1998–8/31/1998	-14.50%	0.58	0.43	0.37	0.53	0.22	0.21
Tech Bubble	08/31/2000–9/30/2002	-44.70%	0.41	0.39	0.37	0.35	0.32	0.33
Financial Crisis	11/30/2007–2/27/2009	-48.80%	0.46	0.46	0.47	0.45	0.39	0.36
Entire Period ex above Crisis		-	0.33	0.33	0.33	0.33	0.33	0.33

Sources: WisdomTree, FactSet, for the period 12/31/1994–06/30/2018. Past performance is not indicative of future results. You cannot invest directly in an index. M = months.

Consistency of Correlation Curve Signal

Next, to analyze the consistency and predictive ability of this correlation curve, I segregated the S&P 500's average monthly performance in months immediately following two regimes:

    1. **Risk Off:** When the correlation curve was in backwardation (downward sloping) or near-term correlations spiked[1]

    2. **Risk On:** When the correlation curve was in contango (upward sloping) or near-term correlations declined[2]

There was a substantial divergence in performance in the months following these signals.

Shape of Correlation Curve	Risk Indication	No. of Months	Monthly Returns of S&P 500
When Correlation Curve is in Backwardation *(i.e., near-term correlations > far term correlations)*	RISK OFF	60	0.3%
When Correlation Curve is in Contango *(i.e., when near-term correlations < far term correlations)*	RISK ON	86	1.3%

Sources: WisdomTree, FactSet, for the period 12/31/1994–06/30/2018. Past performance is not indicative of future results. You cannot invest directly in an index.

Not only did near-term correlations spike in crisis periods each time, but this also resulted in meaningful separation of performance in months that followed the spikes in correlations. To me, this correlation data thus carries meaningful information about stock behavior!

How Has the Correlation Curve Moved in 2018?

In January 2018, I noticed a pickup in this correlation curve compared with the December curve. This pickup was followed by a very sharp increase that continued in February, consistent with a massive spike in the Volatility Index on February 5, something that I covered in my blog post "What Do Rising Correlations Signal?". Since then, near-term correlations have cooled, implying a sharp reduction in risk that was building up a few weeks earlier.

Spike in Near- Terms Average Correlations in 2018 Causing Backwardation in Correlation Term Structure

Sources: WisdomTree, FactSet, as of 6/30/18. Past performance is not indicative of future results. M = month.

WisdomTree Solutions and Conclusions

As a leader of modern alpha strategies, WisdomTree constantly looks for factors that can help explain market behavior. When we launched our WisdomTree U.S. Multifactor Fund (USMF) in 2017 with an aim to provide multifactor exposure to the U.S. stocks, we used a combination of fundamental (value and quality) and technical (momentum and correlations) factors. The strategy aims to hold a basket of stocks that have the highest average score of all four factors, including correlations (stocks with low correlations having higher scores). While each of our factors adds value based on our proprietary methodology, correlation as a factor stands out: no other multifactor products currently offer a unique combination of correlation with the other more-common factors.

WisdomTree is very pleased that our research is proving itself with since-inception returns of USMF better than most other popular multifactor strategies, something that our chief investment strategist recently covered in detail.

In my opinion, correlation is a key piece of the factor puzzle: it can not only help explain how individual securities fit in a portfolio but also explain overall market behavior. On one hand, watching market correlations can give investors key insights into imminent market cycles; on the other hand, correlation as a factor combined with other factors can also help contribute to solid outperformance.

[1]Curve was deemed to be in backwardation or downward sloping if nearest value (i.e., one-month average correlations) and farthest-out value (i.e., 36-month average correlation) are maximum and minimum, respectively, with an error or .05.

[2]Curve was deemed to be in contango or upward sloping if nearest value (i.e., one-month average correlations) and farthest-out value (i.e., 36-month average correlation) are minimum and maximum, respectively, with an error or .05.

Important Risks Related to this Article

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For the top 10 holdings of USMF please visit the Fund's fund detail page at https://www.wisdomtree.com/investments/etfs/equity/usmf

For standardized performance and the most recent month-end performance click here NOTE, this material is intended for electronic use only. Individuals who intend to print and physically deliver to an investor must print the monthly performance report to accompany this blog.

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DEFINITIONS

Capital asset pricing model (CAPM) : a model that describes the relationship between systematic risk and expected return for assets, particularly stocks. CAPM is widely used throughout finance for the pricing of risky securities, generating expected returns for assets given the risk of those assets and calculating costs of capital.

Risk premium : Equity investments are not risk free, but it is thought that investors buy stocks because the returns they expect are high enough to allow them to take the risk.

Fama-French : Refers to a factor-based model to describe stock returns developed by Eugene Fama and Kenneth French. Their original three-factor model breaks down the components of stock returns to market risk, company size and book to market ratio, or value.   .

Size : Characterized by smaller companies rather than larger companies by market capitalization. This term is also related to the Size Factor, which associates smaller market-cap stocks with excess returns vs the market over time.

Value : Characterized by lower price levels relative to fundamentals, such as earnings or dividends. Prices are lower because investors are less certain of the performance of these fundamentals in the future. This term is also related to the Value Factor, which associates these stock characteristics with excess returns vs the market over tim.

Momentum : Characterized by assets with recent price increase trends over time. This term is also associated with the Momentum Factor which associates these stock characteristics with excess return vs the market over time.

Quality : Characterized by higher efficiency and profitability. Typical measures include earnings, return on equity, return on assets, operating profitability as well as others. This term is also related to the Quality Factor, which associates these stock characteristics with excess returns vs the market over tim.

Smart Beta : A term for rules-based investment strategies that don't use conventional market-cap weightings.

Modern Alpha : Modern Alpha® combines the outperformance potential of active with the benefits of passive—to offer investor strategies that are built for performance.

Volatility : A measure of the dispersion of actual returns around a particular average level. .

Correlation : Statistical measure of how two sets of returns move in relation to each other. Correlation coefficients range from -1 to 1. A correlation of 1 means the two subjects of analysis move in lockstep with each other. A correlation of -1 means the two subjects of analysis have moved in exactly the opposite direction.

Yield curve : Graphical Depiction of interest rates on government bonds, with the current yield on the vertical axis and the years to maturity on the horizontal axis.

Interest rates : The rate at which interest is paid by a borrower for the use of money.

Duration : A measure of a bond's sensitivity to changes in interest rates. The weighted average accounts for the various durations of the bonds purchased as well as the proportion of the total government bond portfolio that they make up.

Yield : The income return on an investment. Refers to the interest or dividends received from a security that is typically expressed annually as a percentage of the market or face value.

Inflation : Characterized by rising price levels.

S&P 500 Index : Market capitalization-weighted benchmark of 500 stocks selected by the Standard and Poor's Index Committee designed to represent the performance of the leading industries in the United States economy.

Risk-on/risk-off : refers to changes in investment activity in response to perceived risk. During periods when risk is perceived as low, investors tend to engage in higher-risk investments. When risk is perceived as high, investors tend to

gravitate toward lower-risk investments.