



Understanding Correlation and its Effect on Diversification

Why We Think our Growth Strategies Should Rely on Correlation Analysis for Portfolio Diversification

- Correlation among stocks and across a portfolio can provide a clear sense of a portfolio's true diversification and potential concentration risk
- Some traditional approaches to diversifying portfolios may not deliver sufficient diversification
- Concentrated portfolios may require additional care to ensure adequate diversification
- The systematic application of our Correlation Analysis helps deliver true portfolio diversification

Portfolios with a limited number of holdings can carry certain risks that investment managers must address. While fewer holdings in a portfolio allows each stock to make a meaningful impact on performance, it also exposes investors to increased risk through excess stock concentration. At Torray, our Growth Team firmly believes that one of the most effective tools to tackle that challenge is a thorough Correlation Analysis. We evaluate the correlation of our investments to each other, to our portfolio overall and to other important asset classes and market factors. Our aim is to find low volatility growth companies (using our [“Risk Adjusted Growth” model](#)), whose stocks represent limited correlation to those key categories, in order to build portfolios that can capture the benefits of concentration while managing the risks of insufficient diversification.

Why We Care About Correlation

Generally, diversification and high positive correlation among portfolio constituents are opposing forces. We believe effective managers must find a way to limit correlation and improve diversification, thus reducing downside risk. Correlation is the analysis of the relationship between two data series. Traditionally, this analysis reduces many relations between these two data series into a single number, known as the **correlation coefficient**. It can have a value between 1 and -1, with 0 implying no relationship. Values over 0 imply that when one series increases (decreases), the other also increases (decreases). Values under 0 imply the opposite: when one series increases (decreases), the other decreases (increases). The magnitude of the number explains the degree to which one series' moves are like moves in the other series. The quantitative calculation of the correlation coefficient is shown in Figure 1 (right).

$$\text{Correl}(X, Y) = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

Figure 1: Correlation Coefficient Calculation

An easy way to see how correlation can hurt investors is to think about a three stock portfolio, where all three stocks are similar types of companies and generally go up/down in unison (meaning correlation coefficients close to 1). This is great when they go up, but potentially ruinous when all three stocks go down simultaneously. As a result, investors often seek to “diversify” their portfolios by investing in different industries, different sectors, and even different asset classes – from small-cap to large-cap stocks, and REITs to managed futures, the investment universe provides many ways to diversify a portfolio. However, what appears on the surface as broad diversification may not provide much differentiation underneath.

How We Manage Risk Using Correlation Analysis

In seeking to provide adequate diversification across our portfolios, we utilize a multi-step Correlation Analysis process. This process involves three key elements.

- 1) We create a matrix (Figure 2 below) to see how each stock's price correlates with every other stock in the portfolio over 3, 5, and 10 year periods, with a goal of minimizing correlation in the portfolio. This helps us determine whether stocks that appear different from each other from a business model standpoint, or from the standpoint of industry and sector classification, actually moved differently during various market cycles.

Portfolio	Prospect																
	XYZ ¹		HXL	ABCO	DY	CPRT	MIDD	ICFI	HDS	SBAC	DNKN	LKQ	CHD	CLB
0.73	0.59	HXL	1.00														
0.26	0.19	ABCO	0.09	1.00													
0.29	0.58	DY	0.13	0.42	1.00												
0.74	0.52	CPRT	0.48	0.09	0.23	1.00											
0.77	0.46	MIDD	0.64	0.13	0.34	0.53	1.00										
0.35	0.47	ICFI	0.33	0.23	0.19	0.42	0.26	1.00									
0.57	0.41	HDS	0.59	0.09	0.14	0.45	0.62	0.35	1.00								
0.29	0.18	SBAC	0.15	0.10	-0.01	0.13	0.08	-0.14	0.08	1.00							
0.27	0.12	DNKN	0.37	-0.22	-0.35	0.17	0.21	0.01	0.31	-0.08	1.00						
0.60	0.25	LKQ	0.37	0.29	0.11	0.39	0.56	0.19	0.41	0.13	0.18	1.00					
0.31	0.13	CHD	0.19	-0.05	0.23	0.38	0.24	-0.15	0.09	0.36	0.02	0.01	1.00				
0.42	0.51	CLB	0.30	-0.01	0.29	0.28	0.37	0.31	0.42	0.09	0.08	0.25	-0.07	1.00			
		...	0.59	0.17	0.28	0.55	0.68	0.19	0.45	0.06	0.20	0.57	0.04	0.46	1.00		
		...	0.33	0.12	0.27	0.10	0.43	0.38	0.29	-0.25	-0.06	0.32	-0.11	0.28	0.26	1.00	
		...	0.53	0.36	0.12	0.38	0.49	0.17	0.32	0.08	0.35	0.38	-0.15	0.14	0.61	0.06	1.00
0.64																	

Figure 2: Example Correlation Matrix analyzing Prospect XYZ's 3-yr correlation to individual stocks and the portfolio.

- 2) Our correlation matrix also allows us to examine how each stock correlates to the whole portfolio in aggregate. By taking this more macro view, we can see how likely or unlikely a security is to add diversifying power to the portfolio as a whole based on historical data. This is also an effective way to measure how much risk a security may add to the overall portfolio. We perform "if/then" scenario planning or "sensitivity tests" for stocks that are under consideration for addition to or removal from the portfolio. This analysis provides a more thorough understanding of the diversifying impact that a new stock could have on the portfolio, or how removing a stock could alter the diversification profile of the portfolio.
- 3) While the Correlation Analysis' core focus is to determine how stocks act against one another within the portfolio, it is also important to understand how a stock's price movements have reacted to other factors that impact the market, such as commodity prices, currency fluctuations, or interest rate changes. Our analysis further measures a stock's correlation to these outside factors and helps identify specific exposures that might add to or detract from the goal of diversifying the portfolio. We believe this type of analysis enables us to create more defensive portfolios that are better positioned to weather changes within these external factors. As a tool, we believe our Correlation Analysis provides significant risk management advantages, beyond just helping us achieve true portfolio diversification.

This part of our investment process is essential to our ability to manage risk within a concentrated portfolio. For us, reducing concentration risk generally requires that the stocks in the portfolio behave as individually as possible and that seemingly different stocks do not share hidden attributes that result in them moving in similar directions at similar times. With this tool, we strive to combine the potential benefits of a concentrated portfolio with the diversification benefits often associated with larger portfolios.

How Other Diversification Approaches Can Fail

We believe one of the key shortcomings of traditional diversification approaches is the use of sectors as a means to achieve diversification. Conceptually, investing across industries and sectors should create exposure to companies whose stock performs differently than others. But in reality, the stock prices of

many companies behave a lot like other companies, regardless of industry or sector.

To illustrate this, the following graphic highlights the high correlations between seemingly different sectors. Note the high correlations with each other between most sectors, even from a sector like Health Care that has a reputation for being a diversifier.

Portfolio	Prospect XYZ		Industrials	Tech	Cons Disc	Cons Stpls	Material	Energy	Financials	Healthcare	Biotech (IBB)
0.80	0.67	Industrials	1								
0.85	0.56	Tech	0.62	1							
0.86	0.52	Con Disc.	0.75	0.75	1						
0.59	0.33	Con Staples	0.54	0.43	0.56	1					
0.76	0.55	Material	0.81	0.62	0.70	0.34	1				
0.41	0.35	Energy	0.54	0.23	0.42	0.16	0.63	1			
0.65	0.52	Financials	0.78	0.51	0.65	0.30	0.66	0.47	1		
0.76	0.53	Healthcare	0.67	0.54	0.70	0.53	0.60	0.26	0.59	1	
0.60	0.48	Biotech (IBB)	0.47	0.42	0.52	0.16	0.47	0.13	0.50	0.82	1

As of 9/28/18. Source: Factset. Data represents S&P500 sectors.

Figure 3: Correlation Matrix analyzing Prospect XYZ's correlation to sectors and those sectors of the portfolio's holdings.

In order for the universe of investable companies to be divided into sectors and industries, each company is assigned a GICS code identifier. These codes attempt to assign similar designations to similar types of companies. But in some cases such classifications are problematic at best and potentially misleading at worst. For example, a large multi-national company that makes jet engines would seem to be a natural fit for the Industrials sector, but what if that company also consists of a large financing arm that on its own would fall into the Financial Services sector?

Or, in the case of an IT company whose product line begins to move heavily into the area of home automation or personal wearable products – is what they do more IT-oriented or Consumer Discretionary-oriented? With these concerns in mind, we believe our Correlation Analysis process is a better diversification method and we have integrated it into our process for over 15 years.

During the 2008 crash, correlation coefficients nearly universally converged to 1.0, as all stocks went down and the process appeared to fail during the exact time it was needed most. Had correlations remained at 1.0 into the future, there would be no value in our Correlation Analysis process, but markets have not since displayed this tendency. Instead, correlations generally reverted to their pre-crisis levels, and it was during this reversion that the process continued to add value within our investment process, increasing our confidence to buy the stocks of companies whose fundamentals remained intact.

At Torray, our Correlation Analysis process is an essential part of our focused Growth investment process, employed to help us comprehensively manage risk. In tandem with our Risk-Adjusted Growth model, we thoughtfully strive to deliver growth strategies that reduce the risks often associated with investing in Growth equities.

Disclosures: This commentary is for informational purposes only and should not be viewed as a recommendation to buy or sell any security. Investors should seek financial advice regarding the appropriateness of investing in any securities or investment strategies discussed in this documentation and should understand that statements regarding future prospects may not be realized. There is no guarantee that the views expressed will come to pass.

Torray LLC is an independent registered investment adviser. Registration of an investment adviser does not imply any level of skill or training. For additional information about Torray, including fees and services, please contact us or refer to the Investment Adviser Public Disclosure website (www.adviserinfo.sec.gov).

Investing involves risk; principal loss is possible.

Representative portfolio correlation results presented above are based on past market environments and are no guarantee of future correlations or overall portfolio performance results. Correlation and diversification are intended to be used as a part of the investment decision process, but all investment strategies involve risk, including the potential loss of principal.

The above stock correlation matrix is designed to illustrate a component of the investment process and is not a representation of the strategy's full holdings. Strategy holdings included are subject to change and should not be considered a recommendation to buy or sell any security. There is no assurance that any of the stocks are currently held in the portfolio or will be purchased in the future. These stocks do not represent all securities purchased, sold, held or otherwise recommended for advisory clients. For a list of all recommendations in the past year, contact tawney@torray.com. The analysis does not reflect any other factors that may have been considered in the investment process. The color scheme represents the lowest to highest correlation: blue (less than 0), green (between 0 and 0.25), black (between 0.25 and 0.50) and red (over 0.50), respectively. Data Source: FactSet.