The Volatility of Correlation
Important Implications for the Asset Allocation Decision

by William J. Coaker II, CFP®, CIMA

Executive Summary

- The severity of how much correlation changes, even over longer periods of time, has not been adequately understood.
- This paper analyzes the changing correlation of 15 asset classes measured against the S&P 500 over a 35-year period, and the impact of those changes on asset allocation decisions. It measures the correlations in rolling one-, three-, five-, and ten-year time series, from 1970 to 2004.
- The article also evaluates whether 15 asset classes have helped or hurt in years the S&P 500 has declined, and whether growth or value styles are more correlated to the index.
- The average variance in correlation measured 0.98 over one year and 0.25 over ten years. In short, the relationship among many of the asset classes appears to be inherently unstable.
- Large value provides more diversification benefits than large growth, and small value provides more diversification than small blend or small growth. Emerging markets may provide higher returns and greater diversification than developed nations. But the low correlations of small value and real estate may not hold up during the next broad market decline.
- Correlations exhibit uniqueness, meaning periods are distinct from previous time periods. For example, international stocks' correlation to the S&P 500 was 0.48 from 1970 to 1997, but 0.83 from 1998 to 2002.
- Rather than rely on historical correlations, a more comprehensive and dynamic approach is needed in making asset allocation decisions.

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Correlation measures the direction and degree of a linear relationship between two assets. A correlation of +1.0 indicates two assets have had a perfectly positive relationship, and -1.0 indicates two assets have been perfectly negatively related. A correlation of 0.0 does not imply there has been no relationship; rather, it implies there has been no linear relationship.

Many readers may know that correlations among assets change over time. However, the *severity* of change has not been adequately understood. This article found that the relationship between assets appears to be inherently unstable, which has important implications for the asset allocation decision. The study examines the volatility of correlation for 15 asset classes compared with the S&P 500. The range of relationships to the index over rolling one-, three-, five-, and ten-year time series is summarized in the analysis, and displayed in Tables 1-4. The start date of the study is 1970 or the inception of an asset class index. The end date is 2004. Correlations were calculated using monthly return data. A probability distribution, the standard deviation of correlation, and annual returns for each asset class are available in the tables, as well as in the 35-year summary in Table 5.

Table 1: One-Year Correlations

Distribution	S&P 500	Large Growth	Large Value	Mid-Growth	Mid-Blend	Mid-Value	Small Growth	Small Blend	Small Value	Emerging Markets	Int'l	Inter-mediate Bonds	Cash	High Yields	Natural Resources	Real Estate
.95 to 1.00		81%	59%	35%	46%	25%	12%	9%	8%	1%	1%					
.90 to .94		10%	18%	17%	24%	31%	20%	19%	22%	5%	3%					6%
.85 to .89		8%	10%	17%	18%	20%	16%	15%	11%	9%	6%			1%		5%
.80 to .84		1%	7%	12%	4%	7%	7%	13%	12%	7%	7%	2%		6%		6%
.70 to .79		1%	4%	9%	8%	7%	17%	22%	17%	18%	13%	7%		15%	2%	14%
.60 to .69			1%	3%		6%	12%	11%	15%	15%	18%	11%	2%	22%	1%	12%
.50 to .59				4%		2%	9%	6%	8%	13%	16%	13%	5%	21%	3%	9%
.40 to .49				2%			2%	1%	4%	8%	9%	12%	8%	11%	6%	13%
.30 to .39				2%			2%	1%	2%	11%	4%	12%	11%	6%	6%	14%
.20 to .29							1%	1%	2%	5%	5%	9%	10%	7%	9%	8%
.00 to .19							2%	1%		6%	11%	11%	26%	8%	22%	6%
Negative										3%	8%	23%	37%	5%	50%	6%
Average		0.96	0.93	0.86	0.92	0.88	0.77	0.78	0.76	0.58	0.51	0.27	0.07	0.51	0.01	0.51
High		1.00	1.00	0.99	0.99	0.99	0.97	0.99	0.99	0.96	0.96	0.84	0.74	0.88	0.83	0.95
Low		0.74	0.58	0.28	0.69	0.41	–0.02	0.03	0.13	–0.17	–0.41	–0.77	–0.75	–0.18	–0.78	–0.61
Variance (High vs. Low)		0.26	0.42	0.71	0.30	0.58	0.99	0.96	0.86	1.13	1.37	1.61	1.49	1.06	1.61	1.56
Standard Deviation of Monthly Correlation to the S&P 500		4.0%	7.1%	14.0%	6.9%	10.5%	18.9%	16.4%	17.6%	24.4%	29.4%	37.0%	32.4%	23.9%	31.9%	28.9%

Note: Rounding errors may result in Tables 1 through 4.

Table 2: Three-Year Correlations

Distribution	S&P 500	Large Growth	Large Value	Mid-Growth	Mid-Blend	Mid-Value	Small Growth	Small Blend	Small Value	Emerging Markets	Int'l	Inter-mediate Bonds	Cash	High Yields	Natural Resources	Real Estate
.95 to 1.00		83%	54%	21%	41%	12%							0%			
.90 to .94		17%	23%	22%	38%	33%	15%	16%	12%							
.85 to .89			14%	19%	19%	33%	20%	18%	20%	4%	6%					
.80 to .84			6%	19%	1%	6%	25%	24%	12%	8%	5%			1%		6%
.70 to .79			3%	15%		11%	8%	22%	32%	31%	10%			5%		21%
.60 to .69				4%		6%	24%	16%	16%	9%	13%	4%		33%	1%	24%
.50 to .59							8%	5%	4%	9%	17%	10%		35%	3%	9%
.40 to .49									3%	24%	26%	24%	2%	14%	3%	14%
.30 to .39										13%	16%	14%	7%	7%	6%	11%
.20 to .29										1%	3%	11%	9%	4%	8%	9%
.00 to .19											4%	23%	29%	0%	33%	6%
Negative												14%	52%		45%	1%
Average		0.97	0.93	0.87	0.93	0.87	0.78	0.79	0.77	0.60	0.53	0.25	0.00	0.55	0.02	0.53
High		0.99	0.99	0.96	0.99	0.97	0.94	0.94	0.94	0.87	0.89	0.67	0.51	0.82	0.61	0.84
Low		0.91	0.75	0.67	0.84	0.63	0.52	0.56	0.40	0.29	0.11	–0.51	–0.49	0.10	–0.46	–0.03
Variance (High vs. Low)		0.08	0.24	0.29	0.15	0.34	0.42	0.38	0.54	0.58	0.78	1.18	1.00	0.72	1.07	0.86
Standard Deviation of Monthly Correlation to the S&P 500		2.0%	5.6%	7.5%	3.6%	8.1%	11.9%	9.8%	11.3%	16.6%	18.0%	27.0%	20.0%	11.9%	24.4%	20.0%

Note: Rounding errors may result in Tables 1 through 4.

Table 3: Five-Year Correlations

Distribution	S&P 500	Large Growth	Large Value	Mid-Growth	Mid-Blend	Mid-Value	Small Growth	Small Blend	Small Value	Emerging Markets	Int'l	Inter-mediate Bonds	Cash	High Yields	Natural Resources	Real Estate
.95 to 1.00		83%	51%	13%	36%	8%										
.90 to .94		17%	17%	29%	35%	34%	15%	12%	8%							
.85 to .89			32%	10%	29%	25%	19%	24%	25%		2%					
.80 to .84				22%		5%	17%	15%	10%		8%					
.70 to .79				25%		28%	19%	28%	24%	33%	7%			1%		24%
.60 to .69				1%			24%	20%	31%	20%	16%			16%		27%
.50 to .59							6%	1%	2%	6%	14%	4%		38%		15%
.40 to .49										31%	38%	22%		41%	6%	8%
.30 to .39										10%	14%	18%	2%	4%	11%	6%
.20 to .29										1%	1%	22%	13%	1%	6%	20%
.00 to .19												23%	34%		34%	1%
Negative												11%	51%		44%	
Average		0.96	0.93	0.86	0.93	0.86	0.77	0.79	0.77	0.58	0.53	0.25	0.00	0.52	0.03	0.54
High		0.99	0.98	0.96	0.97	0.95	0.91	0.91	0.91	0.79	0.86	0.57	0.35	0.77	0.49	0.75
Low		0.92	0.85	0.69	0.86	0.75	0.53	0.58	0.59	0.28	0.26	–0.32	–0.35	0.29	–0.34	0.17
Variance (High vs. Low)		0.06	0.13	0.27	0.11	0.20	0.38	0.33	0.32	0.51	0.60	0.89	0.69	0.48	0.83	0.58
Standard Deviation of Monthly Correlation to the S&P 500		1.7%	4.7%	7.4%	3.4%	6.7%	10.9%	8.7%	10.4%	13.6%	14.9%	21.0%	15.7%	8.2%	23.2%	18.1%

Note: Rounding errors may result in Tables 1 through 4.

Table 4: Ten-Year Correlations

Distribution	S&P 500	Large Growth	Large Value	Mid-Growth	Mid-Blend	Mid-Value	Small Growth	Small Blend	Small Value	Emerging Markets	Int'l	Inter-mediate Bonds	Cash	High Yields	Natural Resources	Real Estate
.95 to 1.00		82%	55%		52%											
.90 to .94		18%	24%	35%	22%	37%										
.85 to .89			22%	11%	26%	16%	44%	36%	37%							
.80 to .84				29%		33%	10%	27%	18%							
.70 to .79				25%		15%	26%	26%	17%		9%					5%
.60 to .69							20%	11%	28%	64%	6%					60%
.50 to .59										27%	29%			47%		4%
.40 to .49										9%	52%	4%		53%		12%
.30 to .39											4%	35%		1%		2%
.20 to .29												46%	1%		19%	17%
.00 to .19												12%	69%		37%	
Negative												4%	29%		44%	
Average		0.97	0.94	0.85	0.93	0.86	0.78	0.80	0.78	0.60	0.51	0.26	0.03	0.49	0.04	0.55
High		0.98	0.98	0.94	0.96	0.94	0.88	0.89	0.88	0.40	0.78	0.49	0.23	0.54	0.28	0.71
Low		0.93	0.87	0.76	0.88	0.78	0.61	0.64	0.60	0.69	0.36	–0.05	–0.08	0.39	–0.16	0.25
Variance (High vs. Low)		0.05	0.11	0.18	0.08	0.16	0.27	0.25	0.28	–0.29	0.42	0.54	0.31	0.15	0.44	0.46
Standard Deviation of Monthly Correlation to the S&P 500		1.4%	3.8%	6.2%	3.0%	5.6%	8.8%	7.0%	9.2%	7.6%	9.8%	10.3%	5.8%	2.8%	13.0%	14.6%

Note: Rounding errors may result in Tables 1 through 4.

Table 5: Annual Returns and Monthly Standard Deviation for 35-Year Period

Year	S&P 500	Large Growth	Large Value	Mid-Growth	Mid-Blend	Mid-Value	Small Growth	Small Blend	Small Value	Emerging Markets	Int'l	Inter-mediate Bonds	Cash	High Yields	Natural Resources	Real Estate
1970	3.9	–5.0	10.4				–18.6	–17.4	0.3		–11.7	12.1	7.4		4.9	
1971	14.3	24.0	13.1				23.5	16.5	14.4		29.6	13.2	4.6		–6.1	
1972	19.0	21.5	19.0				3.7	4.4	7.0		36.3	5.7	4.0		30.6	8.0
1973	–14.7	–21.6	–3.6				–39.1	–30.9	–26.0		–14.9	3.4	6.7		102.1	–15.5
1974	–26.5	–29.2	–23.1				–33.4	–19.9	–18.2		–23.2	7.0	8.4		12.8	–21.4
1975	37.2	34.2	57.2				63.2	52.8	54.5		35.4	8.3	6.7		–11.2	19.3
1976	23.9	17.8	44.0				43.5	57.4	53.6		2.5	11.7	5.5		1.3	47.6
1977	–7.2	–9.7	1.4				20.3	25.4	21.8		18.1	3.0	5.2		1.3	22.4
1978	6.6	6.9	3.3				18.6	23.5	21.8		32.6	2.2	7.2		23.0	10.3
1979	18.6	23.9	20.5		32.5		50.8	43.1	35.4		4.8	6.6	10.3		57.5	35.9
1980	32.5	39.6	24.4		32.5		52.3	38.6	25.4		22.6	6.6	11.9		–3.8	24.4
1981	–4.9	–11.3	1.3		2.4		–9.2	2.0	14.9		–1.0	10.8	16.1		–26.5	6.0
1982	21.5	20.5	20.0		23.3		21.0	24.9	28.5		–0.9	25.4	12.3		–3.5	21.6
1983	22.6	16.0	28.3		23.8		20.1	29.1	38.6		24.6	8.2	8.7		17.0	30.6
1984	6.3	–1.0	10.1		1.4		–15.8	–7.3	2.3		7.9	14.3	10.5	9.7	–9.4	20.9
1985	31.7	32.9	31.5		32.0		31.0	31.1	31.0		56.7	18.0	8.3	25.6	3.3	19.1
1986	18.7	15.4	20.0	17.6	18.2	17.9	3.6	5.7	7.4		69.9	13.1	6.7	17.4	–4.9	19.2
1987	5.3	5.3	0.5	2.8	0.2	–2.2	–10.5	–8.8	–7.1		24.9	3.6	6.3	5.0	23.0	-3.6
1988	16.6	11.3	23.2	12.9	19.8	24.6	20.4	24.9	29.5	40.4	28.6	6.4	6.9	12.5	16.7	13.5
1989	31.7	35.9	25.2	31.5	26.3	22.7	20.2	16.2	12.4	65.0	10.8	12.7	9.0	0.8	1.9	8.8
1990	–3.1	–0.3	–8.1	–5.1	–11.5	–16.1	–17.4	–19.5	–21.8	–10.6	–23.2	9.6	7.8	–9.6	4.7	–15.4
1991	30.5	41.2	24.6	47.0	41.5	37.9	51.2	46.1	41.7	59.9	12.5	14.1	5.7	46.2	–1.6	35.7
1992	7.6	5.0	13.8	8.7	16.4	21.7	7.8	18.4	29.1	11.4	–11.8	6.9	3.3	15.7	–1.4	14.6
1993	10.1	2.9	18.1	11.2	14.3	15.6	13.4	18.9	23.8	74.8	32.9	8.2	2.6	17.1	–2.5	19.7
1994	1.3	2.7	–2.0	–2.2	–2.1	–2.1	–2.4	–1.8	–1.5	–7.3	8.1	-1.7	3.7	–1.0	14.0	3.2
1995	37.6	37.2	38.4	34.0	34.4	34.9	31.0	28.4	25.8	–5.2	11.6	15.6	5.3	19.2	11.1	15.3
1996	23.0	23.1	21.6	17.5	19.0	20.3	11.3	16.5	21.4	6.0	6.4	4.7	4.8	11.4	21.7	35.3
1997	33.4	30.5	35.2	22.5	29.0	34.4	12.9	22.4	31.8	–11.6	2.1	8.1	4.9	12.8	4.4	20.3
1998	28.6	38.7	15.6	17.9	10.1	5.1	1.2	–2.5	–6.5	–25.3	20.3	7.4	4.9	1.9	–27.6	–17.5
1999	21.0	33.2	7.3	51.3	18.2	2.1	43.1	21.3	–1.5	66.4	27.3	1.7	4.5	2.4	7.2	–4.6
2000	–9.1	–22.4	7.0	–11.7	8.2	19.2	–22.4	–3.0	22.8	–30.6	–14.0	10.1	5.7	–5.9	42.4	26.4
2001	–11.9	–20.4	–5.6	–20.2	–5.6	2.3	–9.2	2.5	14.0	–2.4	–21.2	8.9	3.4	5.3	–31.7	13.9
2002	–22.1	–27.9	–15.5	–27.4	–16.2	–9.6	–30.3	–20.5	–11.4	–6.0	–16.0	8.9	1.0	–1.4	27.2	3.8
2003	28.7	29.7	30.0	42.7	40.1	38.1	48.5	47.3	46.0	56.3	39.2	2.5	0.4	29.0	29.6	37.6
2004	10.9	6.3	16.5	15.5	20.2	23.7	14.3	18.3	22.2	25.9	20.7	3.5	0.6	11.1	28.6	31.6
Annualized Return 1970 or Inception to 2004	11.2	9.5	13.6	11.7	15.2	13.9	8.6	12.1	14.8	12.9	10.5	8.4	6.3	10.0	7.8	13.3
Monthly Standard Deviation of Returns: Inception–2004	4.5%	5.2%	4.4%	6.3%	4.8%	4.3%	6.9%	6.3%	4.8%	6.7%	4.8%	1.5%	0.3%	2.1%	4.6%	4.0%
Correlation: 1970 or Inception to 2004		0.96	0.92	0.86	0.93	0.87	0.79	0.79	0.78	0.59	0.55	0.23	0.02	0.50	0.01	0.52

Note: S&P 500 down years are highlighted in red.

This article is unique in the depth of analysis concerning the instability of asset relationships and in determining the magnitude and persistence of that volatility over varying time series. The article also evaluates whether 15 asset classes have helped or hurt in down markets, and whether growth or value styles are more correlated to the S&P 500. The article concludes by offering several suggestions on how this information can be used by financial planners.

Due to space limitations, this article focuses solely on the relationship of each of the 15 asset classes to the S&P 500.

But the author intends to pursue further research developing a 16 x 16 matrix (the S&P 500 plus the 15 asset classes in this study) that would examine the interaction among all the asset classes to each other.

Now let's look at each of the 15 asset classes and how their correlations change over time with the S&P 500.
International Stocks

Correlation:

- One year: -0.41 to 0.96
- Three years: 0.11 to 0.89
- Five years: 0.26 to 0.86
- Ten years: 0.36 to 0.78

The correlation of international equities to the S&P 500 was highly erratic for one- and three-year periods. Over ten years, the relationship also varied substantially.

Down markets. In the 2000–2002 bear market, foreign stocks (-44 percent) fell in lock step with the S&P 500 (-38 percent). In the eight down years in the index from 1970 to 2004, international equities were not consistent, outperforming four times and declining more than the S&P 500 four times. International stocks rose in just one of the eight years that the index fell since 1970.

Emerging Markets

Correlation:

- One year: -0.17 to 0.96
- Three years: 0.29 to 0.87
- Five years: 0.28 to 0.79
- Ten years: 0.40 to 0.69

Unpredictability ruled the correlation of emerging markets to the S&P 500 over one- and three-year periods. The five- and ten-year associations also proved inconsistent.

Down markets. In the 2000–2002 bear market, emerging markets (-36 percent) fell in lock step with the S&P 500 (-38 percent). Financial planners who made an allocation to emerging markets in 1998 because the correlation in the previous ten years was a low 0.45 were thwarted by the close connection in the 2000–2002 decline. In the four negative years the S&P 500 experienced since 1988—when the MSCI Emerging Markets Index began—emerging markets declined all four years, losing less than the S&P 500 twice and declining more than the S&P 500 twice.

Real Estate

Correlation:

- One year: -0.61 to 0.95
- Three years: -0.03 to 0.84
- Five years: 0.17 to 0.75
- Ten years: 0.25 to 0.71

One- and three-year associations between real estate and the S&P 500 were very erratic. Even over five and ten years, real estate's relationship to the index was unsystematic.

Down markets. In the eight years the S&P 500 declined from 1970 to 2004, real estate outperformed the index six times, including positive returns four times. From 2000 to 2002, the S&P 500 declined three straight years (-38 percent), while real estate advanced each year (49 percent). Yet sometimes real estate suffered worse in broad market declines. In 1990, when the S&P 500 fell 3.2 percent, real estate plunged 15.4 percent. Also, sometimes when the index advanced sharply, real estate incurred large losses. In 1998, when the S&P 500 rose 28.6 percent, real estate sank 17.5 percent.

Small Value

Correlation:

- One year: 0.13 to 0.99
- Three years: 0.40 to 0.94
- Five years: 0.59 to 0.91
- Ten years: 0.60 to 0.88

One-year correlations between small value and the S&P 500 ranged from very low to marching in lock step with the index. Over three years, the relationship varied substantially, and over five and ten years it varied from modest to strong.

Down markets. Small value outperformed the S&P 500 in six of the eight years the index declined from 1970 to 2004, including gains in four years. In 2000–2001 when the S&P 500 sank 9.0 percent and 11.9 percent, small value gained 22.8 percent and 14.0 percent. In 1977 the index fell 7.2 percent, while small value soared 21.8 percent. But small value did not always help cushion a portfolio when the S&P 500 declined. In 1973, when the index fell 14.7 percent, small value nose-dived 26.0 percent. In 1990, when the index lost 3.2 percent, small value plunged 21.8 percent. Further, sometimes small value is ignored during broad market advances. In 1998–1999 when the S&P 500 gained 55.6 percent, small value lost 7.9 percent.

Small Blend

Correlation:

- One year: 0.03 to 0.99
- Three years: 0.56 to 0.94
- Five years: 0.58 to 0.91
- Ten years: 0.64 to 0.89

Small blend's one-year connections to the S&P 500 were very erratic, ranging from near zero to moving in tandem. Over three, five, and ten years, the relationship ranged from modest to strong.

Down markets. In the S&P 500's eight down years from 1970 to 2004, small blend outperformed six times, earning positive returns three times. In 1977, when the index lost 7.2 percent, small blend soared 25.4 percent.

But sometimes small blend fared much worse in broad declines, and in other years it lost large sums in flat or up markets. In 1973 the S&P 500 lost 14.7 percent, but small blend was battered (-30.9 percent). In 1990, when the index fell 3.2 percent, small blend plunged 19.5 percent. In 1970, when the S&P 500 inched up 3.9 percent, small blend lost 17.4 percent.

Small Growth

Correlation:

- One year: -0.02 to 0.97
- Three years: 0.52 to 0.94
- Five years: 0.53 to 0.91
- Ten years: 0.61 to 0.88

One-year relationships between small growth and the S&P 500 were highly erratic. Three-year connections varied substantially, and over five and ten years the relationship proved inconsistent.

Down markets. Small growth was usually crushed in broad market declines. In the eight down years in the S&P 500 from 1970 to 2004, small growth lost more than the index six times. Four particularly tough years were 1973, 1974, 2000, and 2002, with an average decline of 31.3 percent. One significant exception was in 1977. That year the index lost 7.2 percent, but small growth soared 20.8 percent.

Mid-Value

Correlation:

- One year: 0.41 to 0.99
- Three years: 0.63 to 0.97
- Five years: 0.75 to 0.95
- Ten years: 0.78 to 0.94

One-year associations between mid-value and the S&P 500 were very inconsistent, and three-year relationships varied considerably. Five- and ten-year correlations ranged from moderate to strong.

Down markets. The S&P 500 declined in four years since the Russell Midcap Value Index was formed in 1986. Mid-value outperformed three of those times, but the one year it lost more, it did so by a large margin. In 1990 when the index lost 3.1 percent, mid-value was rocked (-16.1 percent).

Mid-Blend

Correlation:

- One year: 0.69 to 0.99
- Three years: 0.84 to 0.99
- Five years: 0.86 to 0.97
- Ten years: 0.88 to 0.96

One-year relationships between mid-blend and the S&P 500 were moderate to moving in lock step, while three-, five-, and ten-year periods were rather consistent.

Down markets. The S&P 500 declined in five years since the Russell Midcap Index was formed in 1979, and mid-blend performed better than the index four of those times. From 2000 to 2002, when the index swooned (-38 percent), mid-blend fell just 14 percent.

Mid-Growth

Correlation:

- One year: 0.28 to 0.99

- Three years: 0.67 to 0.96
- Five years: 0.69 to 0.96
- Ten years: 0.76 to 0.94

Mid-growth's one-year connections to the S&P 500 were highly erratic, ranging from very low to super tight. Three-year and five-year relationships ranged from modest to very close, while ten years proved a little closer.

Down markets. Since the Russell Midcap Growth Index was formed in 1986, the S&P 500 declined in four years, and mid-growth lost more than the index all four times. The worst underperformance was in 2001 when the S&P 500 lost 11.9 percent and mid-growth slumped 20.2 percent.

Large Value

Correlation:

- One year: 0.58 to 1.00
- Three years: 0.75 to 0.99
- Five years: 0.85 to 0.98
- Ten years: 0.87 to 0.98

The variance in one and three-year relationships between large value and the S&P 500 was larger than one might expect, while variances over five years and longer ranged from strong to moving in tandem. Large value is about tied with mid-blend for the second tightest relationship to the S&P 500.

Down markets. In the S&P 500's eight down years since 1970, large value outperformed the index seven times. When the index sank 14.7 percent in 1973, large value lost just 3.6 percent. In the 2000-2002 bear market, when the S&P 500 melted 38 percent, large value fell 15 percent. But during that decline, the relationship changed each year. It was low in 2000 (large value gained 7 percent while the index lost 9 percent), moderate in 2001 (-5.6 percent versus -11.9 percent), and strong in 2002 (-15.5 percent versus -22.1 percent). Unfortunately, when the one-year large value lost more than the S&P 500, in 1990, it did so by a large margin: -22.1 percent to -3.2 percent.

Large Growth

Correlation:

- One year: 0.74 to 1.00
- Three years: 0.91 to 0.99
- Five years: 0.92 to 0.99
- Ten years: 0.93 to 0.98

Large growth had the strongest relationship to the S&P 500. Except for 1972, the correlations were very tight.

Down markets. In the eight years the S&P 500 declined since 1970, large growth lost more than the index seven times. The exception was 1990 (-0.3 percent versus -3.2 percent). In six of those eight years, large growth lost at least 5 percent more than the index.

Intermediate Bonds

Correlation:

- One year: -0.77 to 0.84

- Three years: -0.51 to 0.67
- Five years: -0.32 to 0.57
- Ten years: -0.05 to 0.49

Even though intermediate bond's relationship to the S&P 500 had large ranges across all time series, bonds provided high diversification benefits with a 35-year correlation of 0.23 and a high of just 0.57 for any 5-year time period.

Down markets. During all eight years that the S&P 500 declined since 1970, intermediate bonds earned positive returns. Bonds also earned positive returns in 24 of the 26 years the index declined from 1926 to 2004. The exceptions were 1931 (bonds fell 2.3 percent) and 1969 (-0.7 percent).

High Yields

Correlation:

- One year: -0.18 to 0.88
- Three years: 0.10 to 0.82
- Five years: 0.29 to 0.77
- Ten years: 0.39 to 0.54

Instability ruled the one- and three-year correlations between high yields and the S&P 500, and substantial inconsistency persisted for five-year periods. But over ten years the variance was the fourth lowest of the 15 asset classes evaluated.

Down markets. The S&P 500 has declined four years since the inception of the Lehman Brothers High Yield Index in 1983. Three times high yields performed better than the S&P 500, but they earned positive returns just once.

Natural Resources

Correlation:

- One year: -0.78 to 0.83
- Three years: -0.46 to 0.61
- Five years: -0.34 to 0.49
- Ten years: -0.16 to 0.28

While natural resources' relationship to the S&P 500 had significant variances across all times series, the asset class had a 35-year correlation of 0.01 and a high of just 0.49 for any five-year period. In 17 of 35 years from 1970 to 2004, natural resources had a negative relationship to the index.

Down markets. In the S&P 500's eight down years from 1970 to 2004, natural resources earned positive returns six times. The most positive contributions in down markets were 1973 (102.1 percent versus -14.7 percent), 1974 (12.8 percent versus -26.5 percent), 2000 (42.4 percent versus -9.0 percent), 2002 (27.2 percent versus -22.1 percent).

Unfortunately, sometimes natural resources were battered much worse during broad declines. In 1981, when the S&P 500 fell 4.9 percent, natural resources plunged 26.5 percent. In 2001, when the index lost 11.9 percent, natural resources swooned (-31.7 percent). Further, natural resources often declined during a market advance. Since 1970, natural resources declined in ten years when the S&P 500 advanced.

Cash

Correlation:

- One year: -0.75 to 0.74
- Three years: -0.49 to 0.51
- Five years: -0.35 to 0.35
- Ten years: -0.08 to 0.23

Associations of cash to the S&P 500 had large ranges, but diversification benefits were high.

Down markets. Cash earned positive returns all eight years that the S&P 500 fell from 1970 to 2004. But returns varied depending on the underlying conditions. In 1981, cash gained 16.1 percent when interest rates were pushed to all-time highs to choke out high inflation. On the other hand, cash gained just 0.4 percent in 2002 when interest rates were reduced to 50-year lows to ward off recession, during a decline in trust in public equity, and worries about war and terrorism.

Observations

Most relationships of these 15 asset classes to the S&P 500 were unstable:

- The average variance in correlation over one year was 0.99.
- The average variance over three years was 0.57.
- The average variance over five years was 0.43.
- The average variance over ten years was 0.27.
- Assuming a variance of 0.20 or greater as lacking consistency, then 13 of 15 asset classes over three years, 12 of 15 over 5 years, and 9 of 15 over 10 years had inconsistent relationships to the S&P 500. If the assumption were tightened to variances of 0.15 as lacking consistency, then 14 of 15 asset classes over three years, 12 of 15 over 5 years, and 12 of 15 over 10 years had inconsistent relationships to the index.

Relationships in down markets have also been inconsistent. Among equities, large value was most likely to outperform the S&P 500 in down years, but not always. Small value and mid-value also tended to outperform the index in down years, but not with reliable consistency. All growth styles usually lost more than the index in down years, but not always. International and emerging markets had an equal occurrence of losing less and losing more than the index.

Real estate often outperformed when the S&P 500 declined, and natural resources tended to earn positive returns when the market dropped. But both assets sometimes lost a lot more when the index declined.

Only cash always earned positive returns when the S&P 500 declined, and intermediate bonds almost always did. In short, most asset classes were inconsistent in whether they earned positive returns, lost less, or lost more than the index in down markets.

Conclusions and Suggestions

In this section, ideas are presented on how financial advisors may be able to use the information presented in this article in making asset allocation decisions.

Large value versus large growth. Large value has provided more diversification benefits than large growth, and large value has usually outperformed both the index and large growth in down markets. Large growth's consistently strong relationship to the S&P 500 raises a question of whether it is helpful to combine large growth with the index because the diversification benefits have been low.

Small and mid-caps. Small value has provided more diversification benefits than both small blend and small growth,

and has usually outperformed both styles in down markets. Small growth tends to have a lower correlation to the S&P 500 than small blend, but the latter has had better downside resistance. Across all styles-value, blend, and growth-small stocks have provided more diversification benefits than mid-caps.

Whether growth or value styles relate closer to the S&P 500. Large growth has been more connected to the S&P 500 than large value. Small growth has been somewhat more connected to the index than small value. Hence, for large and small caps, consider using value with either blend or growth, but not both, since blend and growth appear closely connected. Among mid-caps, though, growth had slightly lower correlations to the S&P 500 than value, but value provided better downside resistance.

Emerging markets versus international stocks. The supporting tables show that emerging markets have had lower connections to the S&P 500. Further, emerging markets face fewer challenges related to aging societies than developed nations. Emerging markets may provide higher returns and greater diversification benefits than developed nations.

Intermediate bonds versus high yields. Intermediate bonds have provided higher diversification benefits than high yield. While high yields have generally declined when equities fall, bonds have almost always earned positive returns.

Understanding market uniqueness. Market periods exhibit uniqueness, meaning each period is distinct from all prior time series. Here are some recent examples.

- From 1950 to 1959, equity returns of 19 percent annually were unprecedented
- Until the 1960s–1970s, the United States never experienced systemic inflation, and investors never experienced a decade of negative real returns
- Equity gains of 18.2 percent from 1982 to 1999 and bond returns of 9.2 percent were unparalleled for such a long period
- The severe de-link of growth and value styles from 1995 to 2002 was unprecedented
- The failure of record monetary and fiscal stimulus to ward off three straight years of equity declines was unique

Correlations also exhibit uniqueness. Here are some recent examples:

- From 1970 to 1997 the correlation of international stocks to the S&P 500 was 0.48, but from 1998 to 2002 it rose to 0.83
- Emerging markets relationship to the index from 1988 to 1997 was 0.45, but from 1998 to 2002 it rose to 0.75
- Small value's correlation to the index from 1970 to 1997 was 0.83, but from 1999 to 2001 it plunged to 0.47
- From 1972 to 1997 real estate's correlation was 0.60, but from 1998 to 2002 it was 0.19.

All these relationships never occurred until recently. Market periods and relationships appear unique, not an average of the past.

Separate returns in down markets into two groups. It is helpful to separate returns in down markets into periods when correlations were high and low. The usual practice is to sum returns in down markets, but that can mask an asset class or product's downside volatility. For example, consider the results of a small-value product and the S&P 500, as shown in Table 6.

Table 6: High Versus Low Correlations in Down Markets

Quarters in Which the S&P 500 Declined	Small-Value Product	S&P 500
1998–2004	–31%	–82%
1998–2004 excluding 2000–2001	–62%	–59%

In quarters when the S&P 500 declined from 1998 to 2004, the small-value product lost only about one-third as much as the S&P 500. Investors would conclude that the product has impressive downside resistance. It does not.

Excluding down quarters in 2000–2001 when value investing de-linked from the index by record levels, the small-value product lost slightly more than the index, resulting in a completely different conclusion about the product's resistance in down markets. Separating returns in down markets into periods when correlations were high and low offers a more complete understanding of a product's potential downside volatility.

Evaluate prospects for future relationships. This article finds that relationships between asset classes are unstable. The asset allocation decision can be improved if we determine how future relationships may prove different from the past. Here are some thoughts on how future relationships may prove different from recent or long-term trends.

- **Small value and real estate.** The low correlation in recent years of small value and real estate to the S&P 500 may not repeat in the next broad market decline. There are two reasons why.
  First, small value and real estate's low correlation to the S&P 500 during the 2000–02 bear market had their roots in the persistence of momentum from 1995 to 1999 when the index soared 251 percent. Comparatively, small value and real estate gained just 85 percent and 47 percent. Based on relative valuation, small value and real estate became a lot cheaper than the S&P 500. The valuation dispersion was corrected from 2000 to 2002 when small value and real estate did well (24 percent and 49 percent, respectively) while the index was crushed (-38 percent).
  Second, the correlation of small value to the S&P 500 could move higher if interest rates move too high. Value firms typically have more debt than do growth companies. When interest rates jump too much, small value can get whacked, as was the case in 1973 (the index fell 14.7 percent versus small value's 26.0 percent decline) and 1990 (the index lost 3.2 percent versus small value's 20.8 percent loss). Real estate could also experience trouble if interest rates move too high. When rates moved up in 1990 and 1998, real estate plunged 17.5 percent and 15.4 percent, respectively. The S&P 500 lost 3.2 percent in 1990 and gained 28.6 percent in 1998.
  Small value and real estate provided positive returns in the 2000–2002 bear market, and they have outperformed in other declines as well. But now that the valuation dispersion has been corrected, investors should not expect small value and real estate to hold up as well in the next decline, particularly if interest rates move up too high.
- **International stocks and emerging markets.** Government and trade deficits in the United States have skyrocketed, while many emerging markets have surpluses. Foreign investors have been the buyers of our debt. If our deficits cause worry among overseas investors and they become sellers, the supply of debt could swamp demand, forcing interest rates higher, in which case U.S. stocks would have trouble. While we can anticipate that closer correlations between the United States and developed markets will persist, if a U.S. equity decline is caused by factors specific to the United States, emerging markets and possibly international stocks may provide better diversification benefits than they have in recent years.
- **Intermediate bonds and high yields.** Bonds can have difficulty when yields are low and interest rates rise. When very low yields in the 1950s began moving up, bonds declined in four out of five years (1955–1959). If foreign investors stop buying our debt en masse, interest rates could move up, causing both bonds and stocks could tumble, and the correlation of intermediate bonds to the index could be higher than its average of 0.23 since 1970. The correlation of high yields to the S&P 500 since 1983 has been just 0.50, but it also could be higher if interest rates climb too high.

Relative valuation. Growth styles are generally priced about 50–75 percent higher than value. When growth outperformed value by record levels from 1995 to 1999, the price/earnings ratio of growth styles averaged 45 versus value's 15, a growth premium of 200 percent. From 2000 to 2002, large, mid-, and small value all significantly outperformed their growth and blend peers. Using relative valuation in the asset allocation decision can boost returns and reduce risk. Now that growth style price/earnings ratios average 22 versus value's 15, a historically low growth premium of 40 percent, the next time series may favor growth styles.

Natural resources. The connection between natural resources and the S&P 500 was 0.49 or less for all 5-year periods, was negative in 17 of the past 35 years, and the 35-year correlation was 0.01. Also, in six of the past eight years that the S&P 500 declined, natural resources earned positive returns.

When considering a strategic allocation to natural resources, several factors should be considered. First, natural resources are dominated by energy (59 percent of the Goldman Sachs Commodity Index), which is very volatile. Natural resource managers have nowhere to hide when things sour. In 1998, the S&P 500 rose 28.6 percent while natural resources plunged 27.6 percent. Even a temperate allocation to natural resources that year caused disappointing returns to a portfolio. Second, while natural resources are sometimes used as a hedge against inflation, treasury inflation protected securities also provide a hedge against inflation with a lot less volatility.

That said, structural forces may favor more exposure to energy than the S&P 500's weight of 7.3 percent. When OPEC (Organization of the Petroleum Exporting Countries) fractured in the early 1980s, the supply of oil far exceeded demand. In the past two decades there has not been a major oil discovery, while demand has soared. Now, supply-and-demand conditions are tight.

China and India have enormous labor supplies, but limited natural resources. If an effective investment strategy is to overweight what China and India will buy, and underweight what they will sell, it may prove helpful to overweight sectors such as energy and industrial materials.

Natural resources and the S&P 500 have had different bull and bear market cycles. From 1970 to 1979, when energy prices soared, natural resources gained 17.9 percent while the S&P 500 gained just 5.9 percent a year. From 1982 to 1999, when energy prices fell, the S&P 500 soared 18.2 percent annually while natural resources gained a mere 1.3 percent a year. From 2000 to 2004 when energy prices again shot up, the S&P 500 fell 2.3 percent a year, while natural resources returned 15.6 percent annually.

Probability. If economic growth persists, interest rates prove tame, inflation remains at bay, oil prices stabilize or fall, global conditions prove peaceful, and terrorism remains at bay, stocks are likely to do well. On the other hand, if interest rates move too high, oil prices surge, inflation heats up, debt levels become more worrisome, or corporate profits disappoint, stocks would decline in lock step with the magnitude of the problem. The range of potential returns is large.

Investment professionals often tell clients, "I think the S&P 500 will be up 10 percent next year," and clients like to hear that. But it almost never happens. From 1926 to 2004, the S&P 500 rose between 8 percent and 14 percent in only six years, an 8 percent occurrence. In fact, just 25 times in 79 years the S&P 500 returned between 0 percent and 20 percent, which is only 32 percent of the time. That means the index has been more than twice as likely to lose money or gain more than 20 percent than to experience returns between 0 percent and 20 percent. Financial planners should express returns in terms of probabilities rather than averages.

Summary

The correlation among asset classes appears to be inherently unstable. Unstable relationships complicate the asset allocation decision. The conventional practice of using historical correlations relies on relationships in the past being the same in the future, which is not correct.

Strategic asset allocation worked brilliantly from 1982 to 1999 because powerful secular forces were especially supportive for both stocks and bonds. Those years saw interest rates, tax rates, inflation, and unemployment all fall dramatically, rapid innovation, record productivity gains, greater free trade among nations, excess oil supplies, and global peace. In 1982–1999, beginning from a base of low valuations and high dividends, and backed by ideal economic and global conditions, stocks and bonds soared 18.2 percent and 9.2 percent a year, respectively. Both are all-time highs for any 18-year period.

In the 1980s and 1990s, investors simply had to participate to make loads of money. But that strategy has not been successful since 2000, and factors such as high consumer and government debt; tight oil supplies; terrorism; above-average valuations; and the aging of developed nations that may adversely affect economic growth, productivity gains, and tax rates, could cause subnormal future returns. On the other hand, if middle classes expand en masse in emerging markets, developed and emerging markets could experience a major secular advance in wealth creation and rising living standards. In short, the range of potential future returns is large. Rather than rely solely on historical

correlations, investment professionals should use a comprehensive and dynamic approach in the asset allocation decision.

Acknowledgments

Monthly return data used to calculate correlation as well as annual returns:

S&P 500: Standard & Poor's

Large Growth: Russell 1000 Growth Index, 1979–2004; Fama and French, 1970–1978

Large Value: Russell 1000 Value Index, 1979–2004; Fama and French, 1970–1978

Mid-Growth: Russell Midcap Growth Index, 1986–2004

Mid-Blend: Russell Midcap Index, 1979–2004

Mid-Value: Russell Midcap Value Index, 1986–2004

Small Growth: Russell 2000 Growth Index, 1979–2004

Small Blend: Russell 2000 Index, 1979–2004, Ibbotson 1970–1978

Small Value: Russell 2000 Value Index, 1979–2004

International: Morgan Stanley Country Index, 1970–2004

Emerging Markets: Morgan Stanley Emerging Markets Index, 1988–2004

Intermediate Bonds: Lehman Brothers, 1973–2004; Ibbotson 1970–1972

High Yields: Lehman High Yield Index, 1984–2004

Natural Resources: Standard & Poor's Commodity Index

Real Estate: National Association of Real Estate Investment Trusts