Mean Reversion of Low and High Stock Returns

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This study investigates mean reversion of low and high stock returns for one- to ten-year periods, using 1,000 random block bootstraps. Regressions of later returns against prior returns of large-cap stocks indicate that high returns generally exhibit more significant mean reversion than low returns. Small-cap stocks display greater mean reversion of high returns for two to four years and low returns for five to ten years. Small-cap stocks show much stronger and more persistent mean reversion in returns than large-cap stocks. Both large- and small-cap stocks, however, provide substantially higher returns following low returns and lower returns following high returns.

Keywords: mean reversion, autocorrelations, stock returns, low returns, high returns, large-cap stocks, small-cap stocks, block bootstrap

INTRODUCTION

There is evidence of mean-reversion in stock returns of large and small U.S. firms over periods of three to five years, indicating that stocks become relatively less risky and provide superior risk-return tradeoffs over longer horizons. Evidence of mean reversion in stock returns provides a rationale for time diversification. Poterba and Summers (1988, p.53) observed that "if stock price movements contain large transitory components, then for long-horizon investors the stock market may be less risky than it appears to be when the variance of single-period returns is extrapolated using the random walk model." Samuelson (1988) demonstrated that investors with relative risk aversion exceeding one will invest greater proportions in stocks if stock returns regress to the mean rather than being serially uncorrelated. As Fisher and Statman (1999) noted, time diversification is based on the belief that the risk of stocks falls as the investment horizon increases, which indicates that young investors should hold large stock proportions and reduce their stock allocations as they grow older.

Stocks have provided highly positive risk premiums on average, but they are risky assets whose returns have fluctuated over time. In order for stocks to provide their average return, below-average returns have to be offset by above-average returns and above-average returns have to be offset by below-average returns. This does not, however, imply that deviations from and reversions to the mean are symmetric below and

above the mean over different investment horizons. Mean reversion may primarily reflect low returns being followed by high returns, or high returns being followed by low returns, if irrational swings in stock prices or rational variations in market risk premiums result in below-average or above-average returns more frequently or persistently. It is also possible that mean reversions of low and high returns occur over different investment horizons and that these patterns are different for relatively safer large-cap and riskier small-cap stocks.

Mean-reversion studies are generally based on all returns that are available during the sample period. Whether the observed mean reversion in stock returns is symmetric for both low and high prior returns or it is primarily due to mean reversion of low or high prior returns has not been empirically investigated. The concept of time diversification emphasizes one aspect of mean reversion in stock returns, namely, high returns compensating for low returns. Kritzman (1994, p.14) stated: "The notion that above-average returns tend to offset below-average returns over long horizons is called time diversification." If mean reversion is mainly due to stock returns rising above the mean and falling back to the mean, over some investment horizons for certain stock market indexes, then mean reversion hurts rather than benefits buy-and-hold investors.

This study examines whether low, medium, and high returns of large- and small-cap stocks exhibit mean reversion over investment horizons of one to ten years. It also determines whether the returns of large- and small-cap stocks are significantly different from prior returns in periods following low, medium, and high returns. Since medium returns do not represent substantial deviations from the mean, they may not display significant mean reversion. Whether mean reversion is equally strong for low and high returns is an empirical issue to be investigated.

LITERATURE REVIEW

In the late 1980's two studies found mean reversion in U.S. stock returns during the period 1926-1985. Fama and French (1988) showed that variations in past returns explained substantial proportions of variations in stock returns for investment horizons of three to five years: 35% for industry portfolios, 25% for large firms, and 40% for small firms. Poterba and Summers (1988) used variance ratios to identify negative autocorrelations in stock returns over periods of three to eight years.

Some researchers attributed the evidence of mean reversion in stock returns to empirical issues, such as small-sample bias (Richardson and Stock, 1989), the January effect (Jegadeesh, 1991), and larger error variances during the Depression and World War II years (Kim, Nelson, and Startz, 1991; McQueen, 1992). Later studies confirmed mean reversion in stock returns using diverse data covering different periods, including seven Southeast Asian stock markets during 1988-95 (Malliaropulos and Priestley, 1999), stock market indexes of 18 countries during 1969-96 (Balvers, Wu, and Gilliland, 2000), and industry portfolios after World War II (Gropp, 2004). More recent studies of U.S. stock returns by Mukherji (2011, 2012) found persistent mean reversion, particularly for stocks of small companies, and stronger mean reversion in abnormal stock returns of both small and large companies.

There are several plausible reasons for mean reversion in stock returns. Tversky and Kahneman (1981) provided experimental evidence showing that people overreact to new information. De Bondt and Thaler (1985) showed that loser stocks outperform winner stocks by 25% over three years. Fama and French (1988) noted that mean reversion might indicate either irrational temporary deviations of stock prices from fundamental values or rational variations in expected returns over time. Cecchetti, Lam, and Mark (1990) suggested that consumption smoothing by investors may account for mean reversion in stock returns. Gangopadhyay and Reinganum (1996) observed that mean reversion may indicate irrational mispricing or rational pricing, depending on whether we assume that the market risk premium is constant or variable. Malliaropulos and Priestley (1999) indicated that expected returns vary over time because the world risk premium is negatively related to the business cycle. Spierdijk, Bikker and Hoek (2012) observed that noise traders might strongly overreact to bad financial news during high economic uncertainty, dropping stock prices well below fundamental values, and they may overreact to good news during economic recovery, raising stock prices well above fundamental values and producing quick mean reversion.

DATA AND METHODOLOGY

Ibbotson (2018) provides total monthly returns of stocks of large and small companies, and changes in the Consumer Price Index for all Urban Consumers (CPI-U) for the years 1926-2017. The empirical distributions of the data for different investment horizons are estimated with the block bootstrap method (Hansson and Persson, 2000), which maintains cross-sectional and serial correlations of the returns. The data are used to draw with replacement 1,000 samples of 240 consecutive months of total nominal returns of large and small companies and inflation rates, starting in random months. This method eliminates the small-sample bias and the January effect. The total nominal stock returns are geometrically reduced by the inflation rate to obtain real returns. Continuously compounded real stock returns are cumulated for periods of 12 to 240 months to derive real stock returns for one to twenty years.

Significant periods of mean reversion of stock returns are identified by regressing later returns against earlier returns of large- and small-cap stocks for periods of one to ten years. For this purpose, the 20-year blocks of returns are split into two blocks of 10-year returns. The first and last ten years of returns in each 20-year block represent the earlier and later returns, respectively. Regressions of one-year returns regress returns in year 11 against returns in year 10, while regressions of ten-year returns regress aggregate returns for years 11 to 20 against aggregate returns for years 1 to 10. To investigate mean reversion of low, medium, and high returns, the 1,000 blocks of returns for each horizon are split into three approximately equal groups, based on the relative level of real returns in the earlier periods. The regressions of one- to ten-year returns are conducted separately for the 333 lowest, 334 medium, and 333 highest earlier returns from the 1,000 blocks of returns.

The regression models are:

$$R_{1,n} = \alpha_n + \beta_n R_{-1,-n} + \varepsilon_{1,n} \tag{1}$$

where $R_{1,n}$ are the continuously compounded real returns for 1 to n years, $R_{-1,-n}$ are the continuously compounded real returns for -1 to -n years, α_n is the intercept, β_n is the slope, $\varepsilon_{1,n}$ are the errors for 1 to n years, and n ranges between 1 and 10 years.

The economic significance of the regression results is evaluated with t-tests for significant differences between the later and earlier returns, separately for periods with low, medium, and high earlier returns of large- and small-cap stocks.

RESULTS AND DISCUSSION

Table 1 presents summary statistics of the cumulative continuously compounded real returns of large- and small-cap stocks for periods of one to ten years. These features are based on the returns in the first ten years of the 1,000 random samples of twenty-year returns, because those are the independent variables whose mean reversion is tested in the regressions. There is, however, no significant difference between the returns in the first and last ten years of the twenty-year blocks. The mean returns are 67.00% in the first ten years and 67.46% in the last ten years for large-cap stocks, and 95.21% in the first ten years and 91.63% in the last ten years for small-cap stocks. The t-statistics for differences in returns between the last and first ten years are 0.17 for large-cap stocks and -1.35 for small-cap stocks.

Panel A of Table 1 shows that large-cap stock returns have higher medians than means in most of the investment periods, but the mean return increases more than the median return over longer periods. The ten-year mean return is almost twelve times the one-year mean return whereas the ten-year median return is about nine times the one-year median return. As a result, the difference between the mean and median returns narrows as the investment period increases. The median is 37% higher than the mean for one-year returns, but it is only 8% higher than the mean for 10-year returns. The standard deviation increases less than three times between one and ten years, so it falls from more than three times the mean for one-year returns to just 76% of the mean for ten-year returns. The maximum return generally increases over the investment periods and the ten-year maximum is almost four times the one-year maximum. By contrast,

the minimum return generally falls with the investment period, and the ten-year minimum is 57% of the one-year minimum. Consequently, the range of returns increases less than two times, from 113% for one year to 213% for ten years.

TABLE 1
DESCRIPTIVE STATISTICS OF CONTINUOUSLY COMPOUNDED REAL STOCK
RETURNS (%) FOR DIFFERENT PERIODS BASED ON 1,000 BLOCK
BOOTSTRAPS FROM 1926-2017

Years	Maximum	Mean	Median	Minimum	Standard Deviation
Panel A. Large-cap Stock Returns					
1	45.51	5.75	7.90	-67.67	17.94
2	78.67	12.03	11.97	-63.03	24.80
3	83.31	19.25	19.53	-54.40	28.45
4	139.58	27.70	27.66	-43.90	32.81
5	143.74	34.09	36.62	-62.43	36.78
6	131.88	40.33	42.55	-60.48	39.11
7	148.55	45.95	44.36	-47.75	41.75
8	152.41	52.60	55.90	-46.12	44.84
9	153.25	59.66	65.55	-51.04	47.78
10	174.51	67.00	72.27	-38.72	50.71
Panel B. Small-cap Stock Returns					
1	94.29	9.04	11.49	-141.35	26.51
2	108.58	18.22	22.15	-111.35	34.37
3	155.98	29.11	31.77	-78.55	39.40
4	216.24	42.38	43.28	-82.66	46.06
5	213.71	52.55	58.02	-102.18	50.28
6	188.92	62.70	65.68	-124.63	48.74
7	207.63	71.65	74.93	-98.27	48.93
8	233.04	79.39	84.88	-72.15	49.14
9	197.86	87.41	94.50	-102.45	49.29
10	189.98	95.21	101.43	-77.85	50.66

Panel B displays similar patterns for small-cap stocks. The median returns are higher than the means for all the investment periods. The mean rises 10.5 times while the median increases 8.8 times between the one- and ten-year periods. The median is more than 27% higher than the mean in one year, but it is less than 7% higher than the mean in ten years. The standard deviation increases less than two times between one and ten years; it is almost three times the mean in one year and only about half of the mean in ten years. The maximum return doubles over the ten-year period. The minimum return fluctuates, but the ten-year minimum is only 55% of the one-year minimum. The range increases by less than 14%, from 236% in one year to 268% in ten years.

These characteristics indicate that the one-year returns of both large- and small-cap stocks are negatively skewed, with means that are well below the medians, but the negative skewness declines as the investment period increases and the means are very close to the medians for ten-year returns. In addition, as the investment horizon lengthens from one to ten years, mean returns rise much more than the volatility of returns, and maximum returns increase whereas minimum returns decrease, for both large- and small-cap stocks. These findings suggest that stocks present better risk-return profiles over longer investment horizons, with less volatility relative to returns. The improvement in risk-return tradeoffs as the investment

period increases is more pronounced for small-cap stocks, suggesting that their returns may display greater mean reversion than the returns of large-cap stocks.

Table 2 indicates that low returns of large-cap stocks exhibit significant mean reversion for periods of one to four, seven, and ten years. Medium returns revert to the mean only over five- and six-year periods. High returns display mean reversion for two to ten years. The adjusted R-squares of significant regressions are about 1% to 4% for low returns, less than 1% for medium returns, and range from 1% to 20% for high returns. These results show that medium returns generally do not revert to the mean and high returns display more persistent mean reversion, which is much stronger than the mean reversion of low returns in most periods. Low returns have stronger mean reversion than high returns only for two- and seven-year returns. The strongest mean reversion by far is for high returns in three- to five-year periods. Overall, these findings show that mean reversion in large-cap stock returns primarily reflects high returns falling back toward the mean, although low returns also rise toward the mean to some extent.

TABLE 2
REGRESSIONS OF CONTINUOUSLY COMPOUNDED REAL LARGE-CAP STOCK (LCS) RETURNS AGAINST LOW, MEDIUM, AND HIGH PRIOR LCS RETURNS FOR DIFFERENT PERIODS BASED ON 1,000 BLOCK BOOTSTRAPS FROM 1926-2017

Years	Intercept	T-statistic	Slope	T-statistic	Adjusted R^2 (%)
Panel A. Regressions of LCS Returns against Low Prior LCS Returns (N = 333)					
1	0.04*	2.49	-0.21*	-2.26	1.22
2	0.11**	7.82	-0.25**	-3.95	4.22
3	0.15**	8.61	-0.28**	-3.26	2.82
4	0.15**	7.22	-0.45**	-3.39	3.07
5	0.26**	11.91	0.05	0.45	-0.24
6	0.25**	11.73	-0.07	-0.68	-0.16
7	0.38**	17.94	-0.32**	-2.69	1.85
8	0.62**	24.35	-0.23	-1.77	0.63
9	0.74**	28.91	-0.19	-1.72	0.59
10	0.88**	33.15	-0.34**	-3.16	2.64
Panel B. Regressions of LCS Returns against Medium Prior LCS Returns (N = 334)					
1	0.05**	2.82	-0.12	-0.58	-0.20
2	0.14**	3.96	-0.09	-0.34	-0.27
3	0.24**	4.37	-0.27	-1.06	0.03
4	0.31**	5.76	-0.00	-0.02	-0.30
5	0.57**	8.05	-0.38*	-1.99	0.88
6	0.77**	6.32	-0.57*	-2.00	0.89
7	0.51**	4.72	0.07	0.32	-0.27
8	0.40**	3.69	0.11	0.53	-0.22
9	0.62**	4.86	-0.18	-0.90	-0.06
10	0.42**	2.74	0.30	1.42	0.31

Years	Intercept	T-statistic	Slope	T-statistic	Adjusted R^2 (%)
Panel C. Regressions of LCS Returns against High Prior LCS Returns (N = 333)					
1	0.07*	2.11	-0.02	-0.16	-0.29
2	0.18**	3.73	-0.25*	-2.04	0.95
3	0.57**	9.12	-0.78**	-6.44	10.88
4	0.79**	12.78	-0.84**	-9.14	19.92
5	0.77**	10.80	-0.65**	-6.98	12.56
6	0.64**	7.47	-0.31**	-3.05	2.43
7	0.70**	6.74	-0.25*	-2.28	1.26
8	0.83**	6.61	-0.28*	-2.34	1.34
9	1.07**	6.74	-0.44**	-3.13	2.59
10	1.17**	6.88	-0.53**	-3.82	3.94

* Significant at 5% level.
** Significant at 1% level.

TABLE 3
REGRESSIONS OF CONTINUOUSLY COMPOUNDED REAL SMALL-CAP STOCK (SCS) RETURNS AGAINST LOW, MEDIUM, AND HIGH PRIOR SCS RETURNS FOR DIFFERENT PERIODS BASED ON 1,000 BLOCK BOOTSTRAPS FROM 1926-2017

Years	Intercept	T-statistic	Slope	T-statistic	Adjusted R^2 (%)
Panel A. Regressions of SCS Returns against Low Prior SCS Returns (N = 333)					
1	0.17**	8.71	0.15*	2.09	1.00
2	0.25**	11.72	0.04	0.56	-0.21
3	0.39**	15.04	0.28**	3.12	2.57
4	0.48**	16.97	-0.23*	-2.30	1.28
5	0.67**	30.80	-0.54**	-9.06	19.62
6	0.83**	35.44	-0.49**	-8.14	16.42
7	1.00**	52.46	-0.50**	-10.12	23.42
8	1.21**	58.70	-0.68**	-14.01	37.04
9	1.32**	80.95	-0.62**	-19.37	52.99
10	1.36**	65.81	-0.46**	-12.33	31.28
Panel B. Regressions of SCS Returns against Medium Prior SCS Returns (N = 334)					
1	0.03	1.26	0.18	0.08	-0.10
2	0.28**	5.48	-0.55*	-2.47	1.51
3	0.55**	7.17	-0.73**	-3.08	2.48
4	0.63**	6.28	-0.52*	-2.29	1.26
5	1.06**	7.49	-0.99**	-3.98	4.27
6	1.01**	6.89	-0.74**	-3.34	2.97
7	1.06**	8.77	-0.68**	-4.28	4.94
8	0.38*	2.08	0.33	1.56	0.43
9	0.17	0.87	0.63**	3.09	2.50
10	1.26**	5.45	-0.40	-1.75	0.62

Years	Intercept	T-statistic	Slope	T-statistic	Adjusted R^2 (%)
Panel C. Regressions of SCS Returns against High Prior SCS Returns (N = 333)					
1	0.10**	2.72	-0.12	-1.19	0.12
2	0.57**	9.47	-0.87**	-7.86	15.49
3	0.51**	7.47	-0.55**	-5.81	8.99
4	0.68**	13.85	-0.57**	-11.04	26.71
5	0.80**	9.32	-0.59**	-7.20	13.28
6	0.86**	5.78	-0.46**	-3.52	3.32
7	1.36**	6.84	-0.72**	-4.46	5.39
8	1.36**	7.88	-0.63**	-4.81	6.24
9	1.07**	4.98	-0.32*	-2.04	0.95
10	0.72**	3.38	-0.01	-0.04	-0.30

* Significant at 5% level.
** Significant at 1% level.

Table 3 reveals that low returns of small-cap stocks display significant mean aversion for one and three years, and mean reversion for four to ten years. Medium returns are mean-reverting for two to seven years and mean-averting over nine years. High returns exhibit significant mean reversion for two to nine years. The mean aversions in short-term low returns and long-term medium returns have low adjusted R-squares of 1% to less than 3%. The mean reversions of low returns over four years and high returns for six to nine years also have relatively low adjusted R-squares of about 1% to 6%. The mean reversions of high returns for two to five years provide higher explanatory power, ranging from 9% for three years to 27% for four years. The mean reversions of low returns for five to ten years also produce even greater explanatory power, ranging between 16% for six years and 53% for nine years.

TABLE 4
DIFFERENCES BETWEEN CONTINUOUSLY COMPOUNDED MEAN REAL RETURNS OF LARGE-CAP STOCKS (LCS) FOLLOWING LOW, MEDIUM, AND HIGH PRIOR LCS RETURNS FOR DIFFERENT PERIODS BASED ON 1,000 BLOCK BOOTSTRAPS FROM 1926-2017

Year	Prior Returns (%)	Later Returns (%)	Differences in Returns (%)	T-statistic	Proportions of Higher Later Returns (%)
Panel A. Differences of LCS Returns Following Low Prior LCS Returns (N = 333)					
1	-14.68	7.49	23.17**	16.33	83.18
2	-15.22	14.33	29.55**	20.89	88.59
3	-12.25	18.95	31.20**	16.85	83.18
4	-8.45	19.08	27.53**	13.11	72.67
5	-7.08	25.26	32.34**	13.74	77.18
6	-4.10	25.52	29.62**	12.44	67.57
7	-0.56	38.05	38.61**	15.59	79.88
8	1.73	61.31	59.58**	20.99	84.38
9	4.22	73.30	69.08**	23.64	88.89
10	7.36	85.67	78.31**	25.43	89.79

Panel B. Differences of LCS Returns Following Medium Prior LCS Returns (N = 334)

1	7.68	4.16	-3.52**	-4.32	43.11
2	12.80	13.23	-0.43	0.30	51.50
3	18.29	20.23	-1.74	-1.22	45.51
4	27.48	30.94	3.46*	2.00	54.49
5	35.65	43.71	8.06**	4.04	55.09
6	41.91	52.90	10.99**	4.60	58.68
7	45.19	54.11	8.92**	3.17	55.09
8	53.34	46.08	-7.26*	-2.56	41.92
9	63.57	51.04	-11.47**	-4.26	44.91
10	72.29	63.84	-8.45**	-2.63	46.71

Panel C. Differences of LCS Returns Following High Prior LCS Returns (N = 333)

1	24.23	6.76	-17.47**	-16.88	15.02
2	38.50	8.72	-29.78**	-18.05	15.92
3	49.77	18.32	-31.45**	-14.46	21.62
4	64.08	24.49	-39.59**	-15.85	17.72
5	73.69	28.83	-44.86**	-18.05	14.41
6	83.17	38.59	-44.58**	-19.37	13.81
7	93.23	46.85	-46.38**	-18.94	14.41
8	102.73	54.02	-48.71**	-18.39	21.32
9	111.17	57.89	-53.28**	-16.81	24.02
10	121.35	52.89	-68.46**	-21.63	13.21

* Significant at 5% level.
** Significant at 1% level.

These findings indicate that mean reversion is more pronounced and persistent for small-cap stocks than for large-cap stocks. For shorter investment periods of two to four years, high returns display significant and stronger mean reversion than low returns, which have significant but weak mean reversion only over four years. For longer horizons of five to ten years, unlike mean reversion in large-cap stocks, mean reversion in small-cap stocks is mainly due to low returns reverting to the mean. Also, even medium returns of small-cap stocks display significant, though relatively weak, mean reversion over short and medium horizons of two to seven years.

Table 4 shows that, for large-cap stocks, low returns are followed by high returns and high returns are followed by low returns. The differences of later returns with both low and high earlier returns are significant at 1% level over all investment horizons. These differences range from 23% for one year to 78% for ten years following low returns, and from -17% for one year to -68% for ten years following high returns. The proportions of higher later returns range between 68% and 90% after low returns, and between 13% and 24% after high returns, indicating that the results are not driven by outliers. Returns after medium returns are also significantly different from earlier returns for all investment periods except two to three years. These differences are negative for one year and eight to ten years, and positive for four to seven years. The differences in returns following medium returns are much lower than the differences following low and high returns, and the proportions of higher later returns range from 42% to 59%. The significant negative differences range from about -4% for one year to about -11% for nine years, and the significant positive differences range from around 3% for four years to around 11% for six years. These findings demonstrate that mean reversions of both low and high large-cap stock returns are highly economically significant for all investment horizons even though the regression results are not statistically significant for some periods.

Table 5 indicates that low and high returns of small-cap stocks are also followed by high and low returns, respectively, and these differences between the later and earlier returns are significant at the 1% level for all investment periods. The differences following low returns range between 33% for one year and 80% for

eight years, while the differences following high returns range between -29% for one year and -75% for eight years. The proportions of higher later returns range from 83% to 93% after low returns, and from 3% to 16% after high returns. Returns following medium returns are significantly lower than earlier returns for all investment periods except three to four years. The significant differences range from about -6% for one to two years to about -19% for eight years. The differences following medium returns are well below the differences following low and high returns, and the proportion of higher later returns ranges between 31% and 52%. These significant though smaller differences between later and earlier returns may be attributed to the fact that the medium prior returns of small-cap stocks are consistently closer to their high returns than to the low returns. For example, the medium one-year return is 29.69 percentage points (pps) higher than the low return but 24.10 pps lower than the high return, and the medium ten-year return is 61.11 percentage points (pps) higher than the low return and 44.88 pps lower than the high return. Since the medium prior returns are relatively high, the following returns are significantly lower.

These results show that mean reversion of low and high small-cap stock returns results in differences between later and earlier returns that are highly economically significant. Also, both low and high small-cap stock returns are followed by returns that have much larger differences with earlier returns than for large-cap stock returns in all periods except ten years, when the differences in returns are slightly lower for large-cap stocks than for small-cap stocks.

CONCLUSIONS

Evidence of mean reversion of stock returns does not imply that variations of returns below and above the mean are symmetric for various investment periods for different stock market indexes. This study examines mean reversion in low, medium, and high returns of large- and small-cap stocks for investment horizons of one to ten years, based on 1,000 random block bootstraps which expand the sample size and avoid the January effect. The regression results indicate that mean reversion of large-cap stocks is mainly due to high returns reverting to the mean; low returns display much weaker mean reversion. Small-cap stocks exhibit much stronger and more sustained mean reversion than large-cap stocks. Mean reversion of small-cap stocks primarily reflects mean reversion of high returns for shorter horizons of two to four years, and mean reversion of low returns for longer periods of five to ten years.

TABLE 5
DIFFERENCES BETWEEN CONTINUOUSLY COMPOUNDED MEAN REAL RETURNS OF SMALL-CAP STOCKS (SCS) FOLLOWING LOW, MEDIUM, AND HIGH PRIOR SCS RETURNS FOR DIFFERENT PERIODS BASED ON 1,000 BLOCK BOOTSTRAPS FROM 1926-2017

Year	Prior Returns (%)	Later Returns (%)	Differences in Returns (%)	T-statistic	Proportions of Higher Later Returns (%)
Panel A. Differences of SCS Returns Following Low Prior SCS Returns (N = 333)					
1	-18.79	14.48	33.27**	18.98	90.09
2	-19.26	23.94	43.20**	20.11	89.49
3	-13.36	35.48	48.84**	19.30	83.48
4	-4.38	49.40	53.78**	15.76	79.88
5	-0.75	67.71	68.46**	18.08	87.39
6	10.29	77.87	67.58**	17.79	82.88
7	17.86	90.69	72.83**	22.23	86.79
8	24.57	104.46	79.89**	22.18	92.49
9	33.10	111.23	78.13**	21.58	89.49
10	39.51	118.01	78.50**	22.68	93.39

Panel B. Differences of SCS Returns Following Medium Prior SCS Returns (N = 334)

1	10.90	5.25	-5.65**	-4.96	38.92
2	21.70	16.06	-5.64**	-3.08	43.41
3	31.74	32.11	0.37	0.20	51.80
4	43.42	40.69	-2.73	-1.32	52.10
5	56.41	50.16	-6.25**	-2.75	47.31
6	65.79	52.35	-13.44**	-6.00	43.71
7	74.87	55.21	-18.34**	-8.85	32.34
8	84.91	65.54	-19.37**	-8.86	32.63
9	93.35	75.59	-17.76**	-9.10	30.54
10	100.62	85.53	-15.09**	-6.11	32.23

Panel C. Differences of SCS Returns Following High Prior SCS Returns (N = 333)

1	35.00	6.22	-28.78**	-16.96	15.92
2	52.22	11.79	-40.43**	-16.54	13.81
3	68.94	13.44	-55.50**	-18.86	10.81
4	88.10	17.58	-70.52**	-20.24	3.00
5	101.97	20.76	-81.21**	-23.05	6.31
6	112.01	34.50	-77.51**	-23.80	3.90
7	122.21	48.38	-73.83**	-19.67	10.21
8	128.66	54.15	-74.51**	-21.15	8.71
9	135.76	63.79	-71.97**	-20.43	12.01
10	145.50	71.37	-74.13**	-24.11	8.71

* Significant at 5% level.
** Significant at 1% level.

Mean reversions of low and high returns are highly economically significant for both large- and small-cap stocks, which provide substantially higher returns following low returns and lower returns following high returns. These differences between later and earlier returns are significant for all investment horizons and they increase with the investment period. Small-cap stocks generally have much larger differences between later and earlier returns than large-cap stocks, following both low and high returns. The differences between the regression and t-test results suggest that although low and high returns may not regularly revert to the mean in a linear manner, they are followed by significantly higher and lower returns, respectively, on average for all investment horizons. Overall, these findings provide empirical evidence that buy-and-hold stock investors obtain substantial gains from time diversification by staying invested in equities after large losses, but they also suffer considerable losses by maintaining equity positions following sizable gains.

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