FINANCIAL SERVICES REVIEW

Financial Services Review 19 (2010) 323–336

Time, risk, and investment styles

Zugang Liu, Ph.D.[a], Jia Wang, Ph.D.[b,*]

[a]*Assistant Professor of Business Administration, Department of Business and Economics, Penn State University, Hazleton, PA 18202, USA*

[b]*Assistant Professor of Finance, Department of Accounting and Finance, Rohrer College of Business, Rowan University, Glassboro, NJ 08028, USA*

Abstract

This paper investigates the changing nature of equity investment risks across time horizon, an important issue in asset allocation decisions. We extend the literature by concentrating on different investment styles and by incorporating investors' risk tolerance into the analysis. Our results show that for more risk-averse investors, the large-cap growth style is the safest style over shorter investment horizons, while a small-cap value style is the safest style over longer investment horizons. However, for more aggressive investors, the small-cap value style is always the safest style regardless of the investment horizons. In addition, the small-growth style is the most risky style across all investment horizons for both types of investors. Those results will help individual investors determine the best suited investment styles given their investment horizon and risk preferences. © 2010 Academy of Financial Services. All rights reserved.

JEL classification: G11

Keywords: Styles; Time horizon; Shortfall risk; Expected loss; Lower partial standard deviation

1. Introduction

Extensive attention has been drawn to the changing nature of the risks across time horizons for different investments, an important issue in asset allocation decisions. For example, Siegel (1994) in his classic book "Stocks for the Long Run" pointed out that although stocks are riskier than bonds in the short run, they are in fact safer (less

* Corresponding author. Tel: +1-856-256-4000, ext. 3461; fax: 856-256-4439.
E-mail address: wangji@rowan.edu (J. Wang).

dispersion) in the long run because of the mean reversion in stock returns (see also, Lloyd and Haney (1980); Lloyd and Modani (1983). Levy (1972) demonstrated that the ranking of Sharpe ratios was dependent on the length of investment horizon. Hodges, Taylor, and Yoder (1997) reported that stocks had higher Sharpe ratios than bonds in the short run but lower ratios in the long run. Hanna and Chen (1999) found that small-cap stocks appeared riskier and more profitable than large-cap stocks for holding periods less than 15 years while small-cap stocks had less risk and more returns for longer holding periods.

The empirical results from those studies provide crucial guidance to practitioners with respect to asset allocation decisions. For example, young investors are commonly advised to invest more in equity compared to investors near retirement age based on the findings that stocks are safer than bonds in the long run. With the increasing popularity of value and growth investment styles and the life cycle fund, it's in great need to analyze the time changing nature in the risks of different investment styles, which motivated this study. We extend the literature as follows.

First, we focus on value versus growth indexes rather than stocks versus bonds. Style indexes are important investment vehicles and are often used as benchmarks to gauge the performance of asset managers. Brinson, Hood, and Beebower (1986) and Brinson, Singer, and Beebower (1991) reported that investment styles explained more than ninety percent of variations of mutual fund returns (see also, Sharpe, 1992; Ibbotson and Kaplan, 2000). Therefore, it's extremely important to understand the risks of the style indexes and how the risks may vary cross time horizons. Ibottson and Reipe (1997) studied various value and growth indexes between 1979 and 1997, and found that the value stock indexes had higher returns and lower volatility during the sample period. However, the authors only examined an 18-year period, and focused on standard deviation, which, as we discuss later in this paper, may not be an appropriate risk measure.

Second, we incorporate investors' degree of risk tolerance when assessing risk. Risk is in the eyes of the beholder. The appropriateness of the risk measure may depend on investors' risk tolerance. In addition, different risk measures may give different ranking. Using a variety of risk measures and linking investors' degree of risk tolerance to each measure, we demonstrate that the ranking of the equity styles is different for investors with different degrees of risk tolerance.

Our results show that for more risk-averse investors, the large-cap growth style is the safest style over shorter investment horizons, while the small-cap value style is the safest style over longer investment horizons. For more aggressive investors, the small-cap value style is always the safest style regardless of the investment horizons. In addition, the small-growth style is the most risky style across all investment horizons for both types of investors.

The rest of the paper is organized as follows: the next (second) section discusses different risk measures; the third section describes the data; the fourth section explains the methodology; the fifth section discusses the empirical results; and the final section discusses our conclusions.

2. Risk measures

As we previously discussed, this paper does not seek to study the benchmark-adjusted returns of portfolios or funds. Instead, we focus on the risks of the style indexes themselves. In most investment textbooks, two types of risk measures are discussed. If the portfolio being evaluated is only a small part of a large investment portfolio, then systematic risk (βs) is the more appropriate measure for portfolio risk evaluation. On the other hand, if the portfolio being evaluated represents the investor's complete portfolio of assets, then total risk is more appropriate. Because our study investigates the risks of equity styles, and treats style indexes as stand-alone investments, we use the measures of total risk to assess the investment risk. In particular, we focus on the downside of asset returns rather than the overall volatility for the following reasons.

First, intuitively, investors are more concerned with the chances that investment returns fall below a target return. According to the Webster dictionary, risk is the possibility of loss or injury. Payne (1973) reported that majority of investors would view risk as the probability and size of a loss, less than 2% would consider risk to be standard deviation. A 1996 survey by the Investment Company Institute reported that 85% of mutual fund investors indicated that they concentrated on downside risk (see Fortuna, 2000). Mr. Warren Buffett's understanding of risk is also consistent with the concept of the downside risk. In his 1993 Letter to Berkshire Hathaway shareholders, he wrote: "In our opinion, the real risk an investor must assess is whether his aggregate after-tax receipts from an investment (including those he receives on sale) will, over his prospective holding period, give him at least as much purchasing power as he had to begin with, plus a modest rate of interest on that initial stake." And even Markowitz (1959) recognized that a semivariance measure of asset risk that focused only on the risks below certain target returns (also known as lower partial standard deviation) would be an intuitively more appealing measure and standard deviation was chosen for technical reasons (see also Sortino and Satchell, 2001).

Second, investors' degree of risk tolerance can be incorporated into downside risk framework. Bawa (1975) shows that a wide range of important downside risk measures can be unified under the concept of Lower Partial Moment (LPM) and can accommodate investors with different levels of risk tolerance (see also Bawa, 1975; Fishburn, 1977; Nawrocki, 1999). LPM can be defined as:

$$LPM(t, k) = \frac{1}{N} \sum_{n=1}^{N} MAX(0, t - r_n)^k \quad (1)$$

where t is the minimal acceptable return, k is the order of lower partial moment, N is the number of return observations, and r_n is the n^{th} return observation. In general, k can be viewed as a measure of risk tolerance and a higher value of k indicates higher level of risk aversion. For example, LPM with k = 0 is the probability of failing to achieve the minimal acceptable return (MAR) and also known as the short fall risk. LPM with k = 1 is the expected value of returns below the MAR and commonly referred to as expected loss. LPM with k = 2 is the variance of returns below MAR and commonly referred to as lower partial variance. The shortfall risk is more appropriate for more aggressive investment behaviors

since the measure only considers the probability of loss, and fails to take into account the size of loss. Lower partial variance or its squared root, lower partial standard deviation (LPSD), is more appropriate for more risk-averse behaviors since it assigns higher weights to greater losses. Bawa (1975) and Fishburn (1977) have shown that the LPM framework is consistent with a general utility model that applies to most investors with different levels of risk aversion, and it does not depend on any restrictive assumptions on return distributions.

Third, standard deviation may sometimes provide misleading results. Bodie, Kane, and Marcus (2006, p. 970), Balzer (1994), and Reichenstein (1986) among others demonstrated various simple examples where safer investments have higher return standard deviations while the downside risk measures could provide correct and consistent results.

The downside risk measures we use in this paper include the shortfall risk, the expected loss, and the lower partial standard deviation. Fishburn (1977) suggested that the minimal acceptable return t can be a ruinous return, zero return, risk free return, and a generally accepted return. In our study, we use the t-bill return as the minimal acceptable rate to calculate LPMs. Those downside risk measures have been widely utilized to study risks of different asset classes across different investment horizons. Butler and Domian (1999) conducted a simple bootstrap procedure to test the impact of the investment horizon on the shortfall risk of equity and fixed income. Maurer, Albrecht, and Ruckpaul (2001) assessed the risk of stocks at different time horizons using the shortfall risk. Mukherji (2002) used the lower partial standard deviation to evaluate the long-run performances of various asset classes including large-cap and small-cap stocks. Jorion (2003) utilized the shortfall risk and the 5% value of risk (VaR) to evaluate the long-run risk of global stock markets. For more discussion regarding the theory and applications of downside risk we refer the audience to Harlow and Rao (1989), Harlow (1991), and Sortino and Satchell (2001).

3. Data

Using Fama-French 5 × 5 portfolios (cap-weighted) formed on size and book-to-market (B/M) ratio, we constructed six style indexes: large-cap value, large-cap growth, mid-cap value, mid-cap growth, small-cap value, and small-cap growth. We picked the first, the third, and the fifth quintile size portfolios (large, medium, and small) from the highest B/M ratio quintile and from the lowest B/M ratio quintile, respectively, as illustrated in Table 1. For each size level, we compare the risks of the value and growth portfolios cross different investment horizons. Fama-French indexes are chosen because it covers the longest time period (July 1926 through December 2008) among all the available style indexes. The Fama-French 5 × 5 portfolios are constructed as follows: First, at the end of each June, all U.S. stocks traded on NYSE, NASDAQ, and AMEX are sorted and divided into five quintiles based on size; secondly, all U.S. stocks are then sorted and divided into five quintiles based on the B/M ratio; finally, as shown in Table 1, the 5 × 5 portfolios are the intersections of the five size portfolios and the five B/M portfolios.

We also conducted the same analysis on the Fama-French 2 × 3 portfolios formed on size and the B/M, which generated consistent results with those of the Fama-French 5 × 5 portfolios. The results are available upon request.

Table 1 The Fama-French 5 × 5 portfolios formed on size and the book-to-market ratio

	Growth →		Book-to-Market Ratio →		Value
Large ↓ Size ↓ Small	Large - Growth				Large - Value
	Mid - Growth				Mid - Value
	Small - Growth				Small - Value

4. Methodology

We conducted both rolling window and bootstrap analyses to compare the risks of value and growth styles across seven different investment horizons (one, five, 10, 15, 20, 30, and 40 years), and obtained consistent results.

4.1. Rolling window analysis

Rolling window analysis is used to reduce the bias in selecting data for a particular historical period (see, e.g., Hanna and Chen, 1999; Mukherji, 2002). To illustrate, consider a five-year window. We first calculated the holding period return for the first five-year period July 1926 through June 1931. Second, we rolled the window one month forward to August 1926 through July 1931 and so on until Jan 2003 through Dec 2008. Then, we converted each five-year return to annualized return and then calculate the mean return, the median return and various risk measures.

4.2. Bootstrap analysis

The major drawbacks of the rolling window analysis are that the observations are strongly auto-correlated, and when the investment horizon gets longer the number of independent observations becomes insufficient. Therefore, in this section we use bootstrap to construct samples that do not suffer from the above problems. The bootstrap technique has been widely utilized in studies that focused on the long-run performances of asset classes (see, e.g., Best et al., 2007; Butler and Domian, 1991; Connelly, 1996; Hodges et al., 1997).

Here we briefly describe how bootstrap is conducted in this study. The Fama-French indexes cover a total of 991 months (July 1926 through December 2008). For a given

Table 2 Descriptive statistics for the monthly returns of the Fama-French 5 × 5 portfolios

	Small-cap		Mid-cap		Large-cap	
	Growth	Value	Growth	Value	Growth	Value
Mean	0.0080	0.0171	0.0095	0.0147	0.0089	0.0124
Median	0.0060	0.0149	0.0137	0.0136	0.0109	0.0132
SD	0.1223	0.0950	0.0764	0.0850	0.0545	0.0756
Skewness	2.8499	3.3023	1.0687	2.0738	−0.0234	0.7110
Kurtosis	32.1070	35.6730	13.9780	24.4860	8.6577	14.5750
Max.	1.4750	1.0531	0.6075	0.8206	0.3552	0.5682
Min.	−0.4936	−0.3487	−0.2963	−0.3728	−0.2821	−0.4556

investment time horizon of n years, we randomly selected $n * 12$ months to construct one n-year holding period, and compound the monthly index returns of the $n * 12$ selected months to calculate the n-year holding period returns. We then convert holding period returns to annualized returns. To illustrate, consider a five year investment horizon ($n = 5$). We randomly select $5 * 12 = 60$ months to construct a five-year period, and calculate the holding period return and the annualized return of this five-year period. We then repeat the process for 100,000 times, which results in 100,000 independent five-year holding periods and associated annualized returns. Based on this distribution of annualized returns, we then compute the mean return, the median return and various risk measures for the value and the growth styles, respectively.

5. Empirical results

Throughout the section we use annualized returns in all the Tables except Table 2. The analyses based on the holding period returns (or terminal wealth) are consistent with the annualized return results, and are available upon request

Table 2 presents the descriptive statistics for the monthly returns of the six selected indexes. At each size level, the value stock index has higher mean return and median return than the growth stock index. For mid-cap and large-cap stocks, the value indexes have higher standard deviations while for small stocks, the value index has lower standard deviations. All indexes are positively skewed except for the large-growth index, which is slightly negatively skewed with a skewness of −0.0234. The kurtosis values of the indexes are all higher than three, which indicate that all indexes have fat tails.

Tables 3, 4, and 5 present empirical results for each size group. It is not surprising to see that the annualized average returns of the value index are higher than those of the growth indexes across all size levels and investment time horizons using both rolling window and bootstrap analyses.

Before we get into the details of the ranking based on the downside risk measures, we would like to bring to your attention that standard deviation may not correctly represent risk in the long run. For a simple example, in Panel A of Table 4, under the column of 20-year window, the standard deviation is 0.035 for the mid-cap value index and is higher than 0.033

Table 3 Large-cap value style vs. growth style: Investment risk across different time horizons

Panel A	Rolling window													
Investment horizon (years)	1		5		10		15		20		30		40	
	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value
Mean	0.119	0.164	0.099	0.130	0.104	0.131	0.106	0.136	0.106	0.136	0.102	0.133	0.100	0.130
Median	0.114	0.158	0.104	0.133	0.104	0.138	0.108	0.135	0.112	0.132	0.100	0.131	0.098	0.131
SD	0.217	0.305	0.084	0.094	0.054	0.055	0.043	0.041	0.034	0.030	0.015	0.014	0.009	0.010
Shortfall risk (t-bill)	0.344	0.329	0.251	0.162	0.171	0.047	0.165	0.000	0.093	0.000	0.000	0.000	0.000	0.000
Expected loss (t-bill)	−0.051	−0.053	−0.013	−0.008	−0.005	−0.001	−0.003	0.000	−0.001	0.000	0.000	0.000	0.000	0.000
LPSD (t-bill)	0.115	0.125	0.031	0.026	0.015	0.004	0.008	0.000	0.003	0.000	0.000	0.000	0.000	0.000
5%VaR	−0.231	−0.255	−0.053	−0.045	0.016	0.041	0.039	0.077	0.052	0.090	0.080	0.111	0.085	0.113
5% Ending wealth	0.769	0.745	0.762	0.796	1.173	1.490	1.782	3.028	2.747	5.554	10.064	23.574	26.347	71.497
50% Ending wealth	1.114	1.158	1.637	1.867	2.699	3.632	4.658	6.674	8.321	12.019	17.513	40.452	42.669	135.244
Sharp ratio (annulized)	0.373	0.412	0.728	0.984	1.196	1.671	1.506	2.348	1.878	3.104	4.049	6.356	6.312	8.781
Value > growth	55.0%		69.0%		78.0%		88.4%		94.2%		100.0%		100.0%	
Panel B	**Bootstrap**													
Mean	0.113	0.161	0.096	0.128	0.094	0.125	0.094	0.123	0.093	0.123	0.093	0.122	0.093	0.122
Median	0.100	0.131	0.093	0.122	0.092	0.122	0.093	0.122	0.093	0.122	0.092	0.121	0.092	0.121
SD	0.209	0.303	0.092	0.131	0.066	0.092	0.053	0.076	0.046	0.065	0.038	0.053	0.033	0.046
Shortfall risk (t-bill)	0.375	0.359	0.268	0.247	0.194	0.173	0.147	0.125	0.111	0.092	0.070	0.053	0.044	0.031
Expected loss (t-bill)	−0.048	−0.059	−0.014	−0.018	−0.007	−0.008	−0.004	−0.004	−0.002	−0.003	−0.001	−0.001	−0.001	−0.001
LPSD (t-bill)	0.099	0.125	0.035	0.045	0.020	0.025	0.013	0.016	0.009	0.011	0.006	0.007	0.004	0.004
5%VaR	−0.205	−0.275	−0.051	−0.077	−0.011	−0.022	0.007	0.002	0.019	0.018	0.032	0.036	0.040	0.047
5% Ending wealth	0.795	0.725	0.770	0.669	0.897	0.803	1.117	1.031	1.445	1.425	2.533	2.883	4.714	6.289
50% Ending wealth	1.100	1.131	1.562	1.781	2.421	3.156	3.779	5.612	5.889	9.958	14.144	30.991	34.061	95.539
Sharp ratio (annulized)	0.360	0.406	0.634	0.691	0.865	0.944	1.051	1.136	1.212	1.311	1.469	1.590	1.687	1.821
Value > growth	56.4%		62.9%		68.1%		71.3%		74.5%		78.9%		82.1%	

Table 4 Mid-cap value style vs. growth style: Investment risk across different time horizons

Panel A	Rolling window													
Investment horizon (years)	1		5		10		15		20		30		40	
	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value
Mean	0.133	0.195	0.098	0.157	0.099	0.159	0.101	0.163	0.102	0.163	0.101	0.163	0.096	0.160
Median	0.126	0.174	0.109	0.169	0.109	0.162	0.103	0.165	0.098	0.168	0.097	0.165	0.098	0.165
SD	0.335	0.356	0.101	0.110	0.055	0.065	0.042	0.044	0.033	0.035	0.018	0.025	0.014	0.018
Shortfall risk (t-bill)	0.325	0.310	0.250	0.114	0.167	0.050	0.153	0.000	0.047	0.000	0.000	0.000	0.006	0.000
Expected loss (t-bill)	−0.069	−0.052	−0.019	−0.009	−0.006	−0.002	−0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LPSD (t-bill)	0.156	0.130	0.047	0.033	0.019	0.008	0.009	0.000	0.002	0.000	0.000	0.000	0.000	0.000
5%VaR	−0.350	−0.244	−0.072	−0.052	−0.002	0.017	0.026	0.074	0.050	0.097	0.075	0.116	0.075	0.124
5% Ending wealth	0.650	0.757	0.687	0.766	0.981	1.187	1.478	2.931	2.649	6.331	8.634	27.207	18.286	108.512
50% Ending wealth	1.126	1.174	1.679	2.185	2.805	4.487	4.333	9.898	6.452	22.374	16.113	97.642	42.024	441.645
Sharp ratio (annulized)	0.282	0.442	0.594	1.077	1.089	1.835	1.459	2.802	1.808	3.459	3.108	4.829	3.754	6.468
Value > growth	61.9%		78.9%		85.6%		93.5%		100.0%		97.1%		100.0%	
Panel B	Bootstrap													
Mean	0.120	0.191	0.090	0.153	0.087	0.149	0.085	0.147	0.085	0.146	0.084	0.146	0.084	0.145
Median	0.085	0.146	0.083	0.143	0.083	0.144	0.083	0.144	0.083	0.144	0.083	0.144	0.083	0.144
SD	0.298	0.352	0.128	0.146	0.089	0.102	0.073	0.083	0.063	0.072	0.051	0.059	0.045	0.051
Shortfall risk (t-bill)	0.427	0.347	0.355	0.217	0.298	0.131	0.260	0.087	0.230	0.060	0.182	0.028	0.150	0.014
Expected loss (t-bill)	−0.073	−0.059	−0.028	−0.015	−0.015	−0.006	−0.011	−0.003	−0.008	−0.002	−0.005	−0.001	−0.003	0.000
LPSD (t-bill)	0.137	0.125	0.058	0.042	0.036	0.021	0.027	0.013	0.021	0.009	0.015	0.004	0.011	0.003
5%VaR	−0.292	−0.276	−0.107	−0.068	−0.053	−0.010	−0.030	0.016	−0.015	0.031	0.002	0.052	0.012	0.063
5% Ending wealth	0.708	0.724	0.568	0.702	0.580	0.908	0.634	1.274	0.733	1.856	1.063	4.523	1.595	11.322
50% Ending wealth	1.085	1.146	1.487	1.952	2.228	3.841	3.310	7.497	4.930	14.706	10.972	56.535	24.013	214.254
Sharp ratio (annulized)	0.278	0.438	0.411	0.789	0.556	1.092	0.659	1.317	0.752	1.508	0.913	1.846	1.035	2.104
Value > growth	63.3%		77.4%		85.9%		90.1%		93.7%		96.9%		98.5%	

Table 5 Small-cap value style vs. growth style: Investment risk across different time horizons

Panel A	Rolling window													
Investment horizon (years)	1		5		10		15		20		30		40	
	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value	Growth	Value
Mean	0.091	0.242	0.035	0.191	0.037	0.185	0.043	0.188	0.047	0.187	0.055	0.188	0.055	0.185
Median	0.044	0.195	0.036	0.179	0.031	0.183	0.048	0.185	0.055	0.183	0.058	0.185	0.059	0.186
SD	0.402	0.458	0.147	0.137	0.086	0.062	0.061	0.039	0.048	0.028	0.033	0.021	0.024	0.015
Shortfall risk (t-bill)	0.497	0.287	0.493	0.119	0.538	0.000	0.501	0.000	0.437	0.000	0.417	0.000	0.283	0.000
Expected loss (t-bill)	−0.119	−0.056	−0.057	−0.009	−0.035	0.000	−0.023	0.000	−0.018	0.000	−0.010	0.000	−0.005	0.000
LPSD (t-bill)	0.212	0.138	0.103	0.031	0.060	0.000	0.043	0.000	0.031	0.000	0.018	0.000	0.011	0.000
5%VaR	−0.443	−0.317	−0.240	−0.048	−0.139	0.090	−0.077	0.127	−0.050	0.144	−0.022	0.156	0.017	0.159
5% Ending wealth	0.557	0.683	0.254	0.783	0.224	2.374	0.303	5.977	0.361	14.698	0.521	77.355	1.936	360.667
50% Ending wealth	1.044	1.195	1.192	2.279	1.360	5.387	2.021	12.724	2.912	28.576	5.494	162.413	9.998	904.177
Sharp ratio (annulized)	0.131	0.444	−0.018	1.122	−0.031	2.376	0.036	3.774	0.120	5.250	0.341	6.998	0.478	9.614
Value > growth	76.5%		98.5%		100.0%		100.0%		100.0%		100.0%		100.0%	
Panel B	Bootstrap													
Mean	0.102	0.229	0.031	0.181	0.023	0.175	0.020	0.174	0.019	0.172	0.018	0.172	0.017	0.171
Median	0.016	0.164	0.014	0.167	0.014	0.168	0.015	0.169	0.015	0.169	0.015	0.170	0.015	0.170
SD	0.478	0.408	0.185	0.161	0.128	0.112	0.104	0.091	0.090	0.079	0.074	0.065	0.064	0.056
Shortfall risk (t-bill)	0.524	0.332	0.552	0.181	0.571	0.100	0.587	0.057	0.599	0.035	0.620	0.014	0.638	0.005
Expected loss (t-bill)	−0.133	−0.056	−0.076	−0.013	−0.059	−0.004	−0.051	−0.002	−0.046	−0.001	−0.041	0.000	−0.037	0.000
LPSD (t-bill)	0.221	0.122	0.124	0.038	0.094	0.018	0.081	0.010	0.073	0.007	0.063	0.003	0.056	0.001
5%VaR	−0.466	−0.271	−0.239	−0.058	−0.172	0.003	−0.141	0.033	−0.122	0.049	−0.099	0.070	−0.084	0.082
5% Ending wealth	0.534	0.729	0.255	0.742	0.151	1.030	0.102	1.620	0.073	2.581	0.044	7.611	0.031	23.748
50% Ending wealth	1.016	1.164	1.072	2.163	1.153	4.741	1.242	10.421	1.347	22.676	1.555	109.674	1.794	528.367
Sharp ratio (annulized)	0.134	0.470	−0.034	0.891	−0.113	1.230	−0.163	1.492	−0.205	1.711	−0.267	2.083	−0.321	2.406
Value > growth	75.3%		91.5%		97.1%		99.0%		99.7%		100.0%		100.0%	

for the mid-growth index. However, mid-cap value index beats the mid-cap growth index 100% of the time for the 20-year horizon, as indicated in the last row of Panel A of Table 4. Similar contradictions can be found in Panel A of Table 4 at the 40-year horizon and Panel A of Table 3 at the 40-year horizon. For more classical examples where the return standard deviation does not correctly reflect the risk in the long run, see Bodie, Kane, and Marcus (2006, p. 970), Balzer (1994), and Reichenstein (1986). It is worth noting that in all the examples above, downside risk measures provide correct and consistent ranking.

Hence, in the remainder of this paper we will use downside risk measures with minimal acceptable rate equal to the t-bill rate to compare the risks of the investment styles. We will first study the risk of the growth style and the value style at each size level. We will then rank the equity styles based on the shortfall risk and the lower partial standard deviations across different time horizons, respectively. As discussed earlier in this paper, the shortfall risk corresponds to more aggressive investment behaviors while the LPSD corresponds to more risk-averse investment behaviors.

Panel A of Table 3 presents the results for the large-cap group based on the rolling window analysis. The shortfall risk of the value style is consistently lower than that of the growth style across all time horizons shorter than or equal to 20 years: 0.329 versus 0.344 for the one-year time horizon and 0.000 versus 0.093 for the 20-year time horizon. From the 30-year horizon forward, both styles' shortfall risks become zero (zero possibility to have a return less than that of t-bill). Therefore, more aggressive investors would consider the large-value style to be safer than the large-growth style for an investment horizon of 20 years or less, and consider both styles to be equally safe for an investment horizon of 30 years or longer. The LPSD of the large-value style is 0.125, and is higher than 0.115 for the large-growth style for the short investment horizon (one year), and becomes lower than that of the large-growth style for a window longer than five years. This switch of the magnitude of the LPSD implies that more risk-averse investors would consider the large-value style to be riskier than the large-growth style in the short run, but less risky in the long run. The expected losses of the two styles exhibit the same trend as the LPSD (t-bill) that indicate that investors with relatively moderate attitude towards risk would consider the large-growth style as the safer style in the short run and the large-value style as the safer style in the long run.

Panel B of Table 3 presents the results for the large cap group using bootstrap analysis, and is consistent with Panel A of Table 3. First, the shortfall risk of the value style is consistently lower than that of the growth style across all time horizons: 0.359 versus 0.375 for the one-year time horizon and 0.031 versus 0.044 for the 40-year time horizon, which indicates that more aggressive investors would consider the large-value style as the safer style for all investment horizons. The LPSD of the large-value style is higher than that of the large-growth style across all horizons shorter than or equal to 30 years, and is equal to that of large-growth style when the time horizon is 40 years. Therefore, for more risk-averse investors, the large-growth style is safer than the large-value style across horizons up to 30 years, and the two styles are equally safe when the time horizon is about 40 years. The expected losses of the two styles show similar patterns across various time horizons as the LPSDs.

Overall, for the large-cap group, the value style is safer than the growth style across all

Table 6 Ranks of risks of investment styles across different time horizons

Panel A	Rolling Window													
Investment Horizon (years)	LPSD (t-bill)							Shortfall Risk (t-bill)						
	1	5	10	15	20	30	40	1	5	10	15	20	30	40
Least Risky	Large-Growth	Large-Value	Small-Value	Three Value Indexes LPSD = 0	Three Value Indexes LPSD = 0	Three Value Indexes and Large and Mid Growth LPSD = 0	Three Value Indexes and Large and Mid Growth LPSD = 0	Small-Value	Small-Value	Small-Value	Three Value Indexes S.R. = 0	Three Value Indexes S.R. = 0	Three Value Indexes and Large and Mid Growth S.R. = 0	Three Value Indexes and Large Growth S.R. = 0
2	Large-Value	Large-Growth	Large-Value					Mid-Value	Mid-Value	Large-Value				
3	Mid-Value	Small-Value	Mid-Value					Large-Value	Large-Value	Mid-Value				
4	Small-Value	Mid-Value	Large-Growth	Large-Growth	Mid-Growth			Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth		
5	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Large-Growth			Large-Growth	Large-Growth	Large-Growth	Large-Growth	Large-Growth		Mid-Growth
Most Risky	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth

Panel B	Boot Strap													
Investment Horizon (years)	LPSD (t-bill)							Shortfall Risk (t-bill)						
	1	5	10	15	20	30	40	1	5	10	15	20	30	40
Least Risky	Large-Growth	Large Growth	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value	Small-Value
2	Small-Value	Small-Value	Large-Growth	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value	Mid-Value
3	Large-Value	Mid-Value	Mid-Value	Large-Growth	Large-Growth	Large-Growth	Large-Growth	Large-Value	Large-Value	Large-Value	Large-Value	Large-Value	Large-Value	Large-Value
4	Mid-Value	Large-Value	Large-Value	Large-Value	Large-Value	Large-Value	Large-Value	Large-Growth	Large-Growth	Large-Growth	Large-Growth	Large-Growth	Large-Growth	Large-Growth
5	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth	Mid-Growth
Most Risky	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth	Small-Growth

time horizons for more aggressive investors; growth style is safer than the value style in the short run, but value style becomes at least as safe as the growth style when the time-horizon is more than 30 years for risk-averse investors.

Table 4 presents the results for the mid-cap group. According to Panel A (rolling window analysis), the shortfall risk of the value style is lower than that of the growth style across all time horizons: 0.310 versus 0.325 for the one-year horizon and 0.000 versus 0.006 for the 40-year horizon. The expected loss of the value style is also better than that of the growth style across all time horizons shorter than or equal to 15 years: −0.052 versus −0.069 for the one-year horizon and 0.000 versus −0.003 for the 15-year horizon. The expected losses of both styles become zero for a 20-year horizon or longer. A similar pattern can be observed using LPSDs: The LPSD of the value style is lower than that of the growth style for horizons of 20 years or less: 0.130 versus 0.156 for the one-year horizon and 0.000 versus 0.002 for the 20-year horizon. The LPSDs of both styles become zero for a 30-year horizon or longer. Bootstrap analysis obtains consistent results (Panel B of Table 4). Thus, for the mid-cap group, almost all investors with various attitudes towards risk would consider the value style as the safer style compared to the growth style.

Table 5 presents the results for the small-cap group. According to Panel A (rolling window analysis), the value style has lower shortfall risk (t-bill) than the growth style across all time horizons: 0.287 versus 0.497 for the one-year horizon and 0.000 versus 0.283 for the 40-year horizon. The value style also has better expected loss (t-bill) compared to the growth style across all time horizons: −0.056 versus −0.119 for the one-year horizon and 0.000 versus −0.057 for the 40-year horizon. The LPSD (t-bill) of the value style is lower than that of the growth style across all time horizons: 0.138 versus 0.212 for the one-year time horizon and 0.000 versus 0.011 for the 40-year time horizon. Bootstrap analysis obtains consistent results, as indicated in Panel B of Table 5. The results shown in Table 5 strongly indicate that for almost all investors with different attitude towards risk, the small-cap value style is safer than the small-cap growth style.

Table 6 summarizes the results by ranking the investment styles based on the shortfall risk and LPSD. Let's first discuss the results using LPSD. For the one-year horizon, the large-growth style is ranked as the safest investment (lowest LPSD) using both the rolling window analysis and the bootstrap analysis. For the five-year horizon, the large-growth style remains the safest using bootstrap analysis and second safest using rolling window analysis. As the holding period lengthens, the large-growth style becomes relatively riskier and the small-value style becomes safer. In particular, the small-value style becomes the safest style for an investment horizon longer than five years. Those results indicate that a more risk averse investor would consider the large-growth style as the safest for a shorter investment window; and the small-value style as the safest for a longer investment window.

The rank based on the shortfall risk exhibits different results than that using LPSD. The small-value style is the dominant style in terms of the shortfall risk across all time horizons. Moreover, the value styles all have lower shortfall risks than the growth styles of similar size across all time horizons. Those results indicate that an investor with higher degree of risk tolerance would consider the value style less risky than the growth style with the small-value style being the safest style regardless of their investment horizon. In addition, both LPSD and the shortfall risk rank the small-growth style as the most risky style across all time horizons.

6. Conclusion

The time-changing nature of the risks of stocks versus bonds has been extensively analyzed and the results are used by practitioners to make asset allocation decisions. In contrast to previous literature, this study concentrates on the time-changing nature of the risks of different equity styles. In addition, we incorporate investors' degree of risk tolerance into the analysis. We find that for more risk-averse investors, the large-cap growth style is the safest style for a shorter investment window, while the small-cap value style is the safest style for a longer investment window. However, more aggressive investors would consider the small-cap value style as the safest style across all time horizons and also view value styles safer than the growth styles of similar size. In addition, the small-growth style is the most risky style across all investment horizons for both types of investors. The results presented in this paper will help individual investors and financial practitioners determine the best suited investment styles given their investment horizon and risk preferences. Although past performance is no guarantee of future performance, history does give individual investors the knowledge of what investment style has been historically safer given investor's unique investment horizon and risk preference.

References

Balzer, L. A. (1994). Measuring investment risk: A review. *Journal of Investing*, *3*(3), 47–58.

Bawa, V. S. (1975). Optimal rules for ordering uncertain prospects. *Journal of Financial Economics*, *2*(1), 96–121.

Best, R., Hodges, C. W., & Yoder, J. A. (2007). The Sharpe ratio and long-run investment decisions. *Journal of Investing*, *16*(2), 70 – 76.

Bodie, Z., Kane, A., & Marcus, A. (2006). *Investments* (7th ed.). New York: McGraw-Hill.

Brinson, G., Hood, R., & Beebower, G. (1986). Determinants of portfolio performance. *Financial Analysts Journal*, *42*(4), 39–48.

Brinson, G., Singer, B., & Beebower, G. (1991). Determinants of portfolio performance II. *Financial Analysts Journal*, *47*(3), 40–48.

Bulter, K. C., & Domian, D. L. (1991). Risk, diversification, and the investment horizon. *Journal of Portfolio Management*, *17*(3), 41–47.

Connelly, T. J. (1996). The time diversification controversy. *Journal of Financial Planning*, *9*(1), 20–23.

Fishburn, P. C. (1977). Mean-risk analysis with risk associated with below-target returns. *American Economic Review*, *67*(2), 116–126.

Fortuna, P. (2000). Old and new perspectives on equity risk. *AIMR Conference Proceedings, Practical Issues in Equity Analysis, February*, 37–45.

Hanna, S., & Chen, P. (1999). Small stocks vs. large: It's how long you hold that counts. *AAII Journal*, *XXI*(6), 26–27.

Harlow, W. V., & Rao, R. (1989). Asset pricing in a generalized mean-lower partial moment framework: Theory and evidence. *Journal of Financial and Quantitative Analysis*, *24*(3), 285–312.

Harlow, W. V. (1991). Asset allocation in a downside-risk framework. *Financial Analysts Journal*, *47*(5), 28–40.

Hodges, C., Taylor, W., & Yoder, J. (1997). Stocks, bonds, the Sharpe ratio and the investment horizon. *Financial Analysts Journal*, *53*(6), 74–80.

Ibbotson, R. G., & Riepe, M. W. (1997). Growth vs. value investing: And the winner is. *Journal of Financial Planning*, *10*(3), 64–71.

Ibbotson, G., & Kaplan, P. (2000). Does asset allocation policy explain 40, 90, or 100 percent of performance? *Financial Analysts Journal, 56*(1), 26–33.

Jorion, P. (2003). The long-term risks of global stock markets. *Financial Management, 32*(4), 5–26.

Levy, H. (1972). Portfolio performance and the investment horizon. *Management Science, 18*(12), 645–653.

Lloyd, W., & Haney, R. (1980). Time diversification: Surest route to lower risk. *Journal of Portfolio Management, 6*(3), 5–9.

Lloyd, W., & Modani, N. (1983). Stocks, bonds, bills and time diversification. *Journal of Portfolio Management, 9*(3), 7–11.

Markowitz, H. R. (1959). *Portfolio selection.* New York: John Wiley & Sons.

Maurer, R., Albrecht, P., & Ruckpaul, U. (2001). Shortfall risks of stocks in the long run. *Financial Markets and Portfolio Management, 15*(4), 481–499.

Mukherji, S. (2002). Stock, bonds, bills, wealth, and time diversification. *Journal of Investing, 11*(2), 39–52.

Nawrocki, D. (1999). A brief history of downside risk measures. *Journal of Investing, 8*(3), 9–25.

Payne, J. (1973). Alternative approaches to decision making under risk: Moments vs. risk dimensions. *Psychological Bulletin, 80*(6), 439–453.

Reichenstein, W. (1986). When stock is less risky than treasury bills. *Financial Analysts Journal, 42*(6), 71–75.

Sharpe, W. (1992). Asset allocation: Management style and performance measurement. *Journal of Portfolio Management, 18*(2), 7–19.

Siegel, J. J. (2002). *Stocks for the long run.* New York: McGraw-Hill.

Sortino, F., & Satchell, S. (eds.). (2001). *Managing downside risk in financial markets: Theory, practice and implementation.* Oxford: Butterworth-Heinemann Finance.