Performance of exchange-traded sector index funds in the October 9, 2007-March 9, 2009 bear market

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ABSTRACT

From October 9, 2007 to March 9, 2009, the U.S. stock market experienced the worse bear market in its history since the Great Depression. U.S. stocks lost about 56% of their value during this period. In this paper, we compare the performances of 38 sector index funds using the Sharpe and Treynor portfolio performance measures and find that the healthcare and consumer staples sector index funds had the best performance and the financials and home construction sector index funds had the worst performance in the October 9, 2007-March 9, 2009 bear market.

Empirical studies demonstrate that sector investments can provide substantial portfolio diversification benefits. Exchange-traded index funds make it easy for investors to achieve sector diversification. The Principal Components Analysis (PCA) is a widely used multivariate technique in empirical studies to assess the portfolio diversification prospects of investments. In this paper, we use the PCA technique and find that investors could maximize portfolio diversification benefit by investing in funds with high factor loadings in different principal components in the October 9, 2007-March 9, 2009 bear market.

Keywords: Exchange-Traded Sector Index Funds, Bear Market, Sharpe and Treynor Portfolio Performance Measures, Principal Components Analysis, Portfolio Diversification

INTRODUCTION

In an economic downturn investors typically move to industries that fare better in bear markets. Although almost all sectors decline during a recession certain industries tend to lose less value. Consumer staples and health-care stocks are sectors that typically decline less than the average. Pharmaceutical companies are included in this group. On the other hand, consumer discretionary stocks fare worse. These industries include home building and car manufacturers. Energy stocks typically experience a smaller decline than the average in a recessionary period but because of the huge increase in the returns of the energy sector in recent years, the energy sector experienced a larger than expected decline in the recent bear market (Patterson, 2008).

Examining the S&P sector performance can provide us with some information as to how specific industries have done over the last two years. The S& P 500 Index experienced a loss of -13.12% and -26.21% for the years ending June 30, 2008 and 2009, respectively. Examining the 10 sectors that comprise the index reveals that consumer staples and healthcare experienced smaller than average losses as expected. The energy (-41.44%), materials (-38.88%), and financials (-38.58%) sectors report higher than average losses for 2009 with financials reporting a loss for 2008 as well.

The information technology sector experienced a smaller negative return than the index while the consumer discretionary sector experienced a slightly larger negative loss relative to the index average over the two year period. Telecom services had close to a -20% loss each year while industrials had a higher than average loss in 2009 and close to the average in 2008. It is noteworthy that while the energy sector showed a significant loss relative to the overall index for 2009, during 2008 energy reported a return of 24.84% while the S&P 500 Index showed a -13.12% decline. The large run up in oil prices in 2008 contributed to the higher return in 2008 and the sharp decline in oil prices led to the subsequent dramatic fall in energy sector returns in 2009 (ICMA-RC Services, 2009). One would expect that the returns of the exchange-traded sector index funds would mirror the corresponding sector performance.

EXCHANGE-TRADED SECTOR INDEX FUNDS

Sector investments have received considerable attention in recent years (see, e.g., Tuluca et al., 2000; Ratner and Leal, 2005; He and Kryzanowski, 2007; and Meric et al., 2005, 2008). Empirical studies demonstrate that sector investments can provide substantial portfolio diversification benefits. Exchange-traded index funds make it easy for investors to invest in sectors to achieve sector diversification.

From October 9, 2007 to March 9, 2009, the U.S. stock market experienced the worse bear market in its history since the Great Depression. U.S. stocks lost about 56% of their value during this period. It would be interesting to determine which sector funds had the best performance and which sector funds had the worst performance, and if sector diversification would be helpful to investors during this bear market. In this paper, we seek answers to these questions.

The study covers 38 Ishares sector index funds that were in existence during the entire October 9, 2007-March 9, 2009 period. The list of the funds studied in the paper is presented in Table 1. Ishares sector index funds provide investment opportunities to investors in the following 9 sectors: Consumer staples/discretionary (5 funds), energy (4 funds), financials (6 funds), healthcare (6 funds), industrials (4 funds), materials (3 funds), technology (6 funds),

telecommunication (2 funds), and utilities (2 funds). Each sector category includes at least one global fund.

Table 1. Ishares Sector Index Funds Included in the Study

Sector	Fund's Name	Ticker Symbol
Consumer Staples/Discretionary	Dow Jones U.S. Consumer Goods Sector Index Fund	IYK
	Dow Jones U.S. Consumer Services Sector Index Fund	IYC
	Dow Jones U.S. Home Construction Sector Index Fund	ITB
	S&P 500 Global Consumer Discretionary Sector Index Fund	RXI
	S&P 500 Global Consumer Staples Sector Index Fund	KXI
Energy	Dow Jones U.S. Energy Sector Index Fund	IYE
	Dow Jones U.S. Oil & Gas Exploration & Prod. Index Fund	IEO
	Dow Jones U.S. Oil Equipment & Services Index Fund	IEZ
	S&P 500 Global Energy Sector Index Fund	IXC
Financials	Dow Jones U.S. Broker-Dealers Index Fund	IAI
	Dow Jones U.S. Financial Sector Index Fund	IYF
	Dow Jones U.S. Financial Services Index Fund	IYG
	Dow Jones U.S. Insurance Index Fund	IAK
	Dow Jones U.S. Regional Banks Index Fund	IAT
	S&P 500 Global Financial Sector Index Fund	IXG
Healthcare	Dow Jones U.S. Healthcare Providers Index Fund	IHF
	Dow Jones U.S. Healthcare Sector Index Fund	IYH
	Dow Jones U.S. Medical Devices Index Fund	IHI
	Dow Jones U.S. Pharmaceuticals Index Fund	IHE
	NASDAQ Biotechnology Index Fund	IBB
	S&P 500 Global Healthcare Sector Index Fund	IXJ
Industrials	Dow Jones U.S. Transportation Average Index Fund	IYT
	Dow Jones U.S. Aerospace & Defense Index Fund	ITA
	Dow Jones U.S. Industrials Sector Index Fund	IYJ
	S&P 500 Global Industrials Sector Index Fund	EXI
Materials	Dow Jones U.S. Basic Materials Sector Index Fund	IYM
	S&P 500 Global Materials Sector Index Fund	MXI
	S&P 500 N. American Natural Resources Sec Index Fund	IGE
Technology	Dow Jones U.S. Technology Sector Index Fund	IYW
	S&P 500 Global Technology Sector Index Fund	IXN
	S&P 500 North American Technology Sector Index Fund	IGM
	S&P 500 N. Amer. Tech.-Multimedia Network. Index Fund	IGN
	S&P 500 N. Amer. Tech.-Semiconductors Index Fund	IGW
	S&P 500 North American Technology-Software Index Fund	IGV
Telecommunication	Dow Jones U.S. Telecommunications Sector Index Fund	IYZ
	S&P 500 Global Telecommunications Sector Index Fund	IXP
Utilities	Dow Jones U.S. Utilities Sector Index Fund	IDU
	S&P 500 Global Utilities Sector Index Fund	JXI

FUND LOSES DURING THE OCTOBER 9, 2007-MARCH 9, 2009 PERIOD

The percentage losses of the funds during the October 9, 2007-March 9, 2009 bear

market period are presented in Table 2. The statistics in the table indicate that the NASDAQ Biochemistry Index Fund had the smallest loss (-30.8%) and the Dow Jones U.S. Financial Services Index fund had the largest loss (-80.5%) during this period. Since the basic cause of the bear market was a crisis related to the financial intermediaries, it is no surprise that the funds that had the largest losses all belong to

Table 2. Losses of the Sector Index Funds During the October 9, 2007-March 9, 2009 Bear Market

Fund's Name	Sector	% Loss
NASDAQ Biotechnology Index Fund	Healthcare	- 30.8%
Dow Jones U.S. Pharmaceuticals Index Fund	Healthcare	- 33.8%
S&P 500 Global Consumer Staples Sector Index Fund	Consumers Staples	- 35.8%
Dow Jones U.S. Healthcare Sector Index Fund	Healthcare	- 37.5%
S&P 500 Global Healthcare Sector Index Fund	Healthcare	- 39.1%
Dow Jones U.S. Consumer Goods Sector Index Fund	Consumers Staples	- 41.5%
Dow Jones U.S. Utilities Sector Index Fund	Utilities	- 44.7%
S&P 500 Global Utilities Sector Index Fund	Utilities	- 44.9%
S&P 500 Global Energy Sector Index Fund	Energy	- 44.9%
Dow Jones U.S. Energy Sector Index Fund	Energy	- 46.3%
S&P 500 Global Telecommunications Sector Index Fund	Telecommunication	- 46.4%
S&P 500 North American Technology-Software Index Fund	Technology	- 47.2%
Dow Jones U.S. Medical Devices Index Fund	Healthcare	- 48.6%
Dow Jones U.S. Oil & Gas Exploration & Prod. Index Fund	Energy	- 50.6%
S&P 500 North American Natural Resources Sector Ind Fund	Materials	- 50.7%
Dow Jones U.S. Consumer Services Sector Index Fund	Consumers Staples	- 51.5%
Dow Jones U.S. Technology Sector Index Fund	Technology	- 51.8%
S&P 500 North American Technology Sector Index Fund	Technology	- 52.5%
S&P 500 Global Technology Sector Index Fund	Technology	- 54.1%
Dow Jones U.S. Healthcare Providers Index Fund	Healthcare	- 54.8%
Dow Jones U.S. Transportation Average Index Fund	Industrials	- 56.0%
S&P 500 Global Consumer Discretionary Sector Index Fund	Consumers Staples	- 57.7%
Dow Jones U.S. Telecommunications Sector Index Fund	Telecommunication	- 59.0%
Dow Jones U.S. Aerospace & Defense Index Fund	Industrials	- 59.4%
S&P 500 Global Materials Sector Index Fund	Materials	- 60.2%
Dow Jones U.S. Basic Materials Sector Index Fund	Materials	- 60.6%
S&P 500 N Amer Technology-Semiconductors Index Fund	Technology	- 61.6%
Dow Jones U.S. Industrials Sector Index Fund	Industrials	- 61.9%
S&P 500 Global Industrials Sector Index Fund	Industrials	- 62.2%
S&P 500 N Amer Tech.-Multimedia Network. Index Fund	Technology	- 63.4%
Dow Jones U.S. Oil & Gas Exploration & Prod. Index Fund	Energy	- 63.9%
Dow Jones U.S. Home Construction Sector Index Fund	Consumers Staples	- 69.5%
Dow Jones U.S. Broker-Dealers Index Fund	Financials	- 71.5%
Dow Jones U.S. Regional Banks Index Fund	Financials	- 74.0%
Dow Jones U.S. Insurance Index Fund	Financials	- 76.7%
Dow Jones U.S. Financial Sector Index Fund	Financials	- 77.9%
S&P 500 Global Financial Sector Index Fund	Financials	- 78.6%
Dow Jones U.S. Financial Services Index Fund	Financials	- 80.5%

the financial sector. Most healthcare sector funds appear to have done quite well during the bear market with relatively smaller losses.

For the following analysis, we have downloaded the daily closing share prices of the

funds, adjusted for dividends and splits, from the "Yahoo/Finance" web site. The daily returns were computed as the natural log difference in the share prices, ln ($P_{i,t}/P_{i,t-1}$).

RETURN VOLATILITY AND MARKET RISK

The standard deviations of the daily returns of the funds for the October 9, 2007-March 9, 2009 period are presented in Table 3. The healthcare and consumer goods funds generally have low daily return volatility. The home construction and financial sector funds have the most daily return volatility.

The S&P 500 index fund (IVV) is used as the market proxy for the U.S. stock market. The market risk contribution of a sector index fund to a well-diversified portfolio is measured by the fund's beta defined as follows:

$$\beta_i = \mathrm{Cov}(R_i, R_{sp}) / \sigma^2_{sp} \quad (1)$$

where β_i is the beta (or market risk) of index fund i, R_i are the daily returns of the index fund, R_{sp} are the daily returns of the S&P 500 index, $\mathrm{Cov}(R_i, R_{sp})$ is the covariance of the index fund returns and the S&P 500 index returns, and σ^2_{sp} is the variance of the S&P 500 index returns.

The market risk of an investor's portfolio is:

$$\beta_p = \sum_{i=1}^{N} w_i \beta_i \quad (2)$$

where β_p is the portfolio's market risk, w_i are the weights of the sector investments in the portfolio, and β_i are the betas of the investments. Therefore, the contribution of a sector index fund to a well-diversified portfolio is measured by the fund's beta as determined by its covariance with the U.S. market index (assumed to be the IVV fund price index).

The fund betas are calculated by regressing each fund's returns against the S&P 500 index fund returns. The fund beta figures are presented in Table 3. The healthcare and consumer goods sectors appear to have low betas. However, the betas of the financials, home construction, and energy sectors are quite high.

COMPARING THE PERFORMANCE OF THE FUNDS DURING THE OCTOBER 9, 2007-MARCH 9, 2009 PERIOD

We compare the performance of the 38 sector index funds during the October 9, 2008-March 9, 2009 bear market period with the Treynor [1965] and Sharpe [1966] portfolio performance measures (see: Reilly and Brown, 2008). In the Treynor method, a higher Treynor ratio (TR_p) statistic indicates a better portfolio performance. The TR_p statistic is calculated as follows:

Table 3. Relative Riskiness of the Funds

Sector Index Funds	Risk	
	Std. Deviation of Daily Returns	Market Risk (Beta)

Dow Jones U.S. Healthcare Sector Index Fund	0.75%	0.66
Dow Jones U.S. Consumer Goods Sector Index Fund	0.76%	0.70
Dow Jones U.S. Pharmaceuticals Index Fund	0.79%	0.67
S&P 500 Global Consumer Staples Sector Index Fund	0.79%	0.69
S&P 500 Global Healthcare Sector Index Fund	0.86%	0.74
NASDAQ Biotechnology Index Fund	0.86%	0.70
Dow Jones U.S. Medical Devices Index Fund	0.86%	0.74
Dow Jones U.S. Utilities Sector Index Fund	0.88%	0.73
Dow Jones U.S. Consumer Services Sector Index Fund	0.95%	0.88
Dow Jones U.S. Aerospace & Defense Index Fund	0.99%	0.90
S&P 500 North American Technology Sector Index Fund	1.01%	0.93
Dow Jones U.S. Technology Sector Index Fund	1.02%	0.94
S&P 500 North American Technology-Software Index Fund	1.02%	0.93
S&P 500 Global Telecommunications Sector Index Fund	1.03%	0.92
S&P 500 Global Technology Sector Index Fund	1.03%	0.94
S&P 500 Global Utilities Sector Index Fund	1.03%	0.87
Dow Jones U.S. Industrials Sector Index Fund	1.03%	0.99
S&P 500 Global Consumer Discretionary Sector Index Fund	1.05%	0.80
Dow Jones U.S. Healthcare Providers Index Fund	1.06%	0.79
S&P 500 Global Industrials Sector Index Fund	1.08%	1.00
S&P 500 North American Tech.-Multimedia Networking Index Fund	1.13%	1.00
Dow Jones U.S. Transportation Average Index Fund	1.14%	0.98
Dow Jones U.S. Telecommunications Sector Index Fund	1.17%	1.05
S&P 500 North American Technology-Semiconductors Index Fund	1.22%	1.01
S&P 500 Global Energy Sector Index Fund	1.40%	1.17
Dow Jones U.S. Basic Materials Sector Index Fund	1.45%	1.25
S&P 500 Global Materials Sector Index Fund	1.47%	1.23
S&P 500 North American Natural Resources Sector Index Fund	1.52%	1.23
S&P 500 Global Financial Sector Index Fund	1.53%	1.38
Dow Jones U.S. Energy Sector Index Fund	1.53%	1.21
Dow Jones U.S. Insurance Index Fund	1.56%	1.29
Dow Jones U.S. Financial Sector Index Fund	1.71%	1.51
Dow Jones U.S. Oil Equipment & Services Index Fund	1.75%	1.38
Dow Jones U.S. Regional Banks Index Fund	1.75%	1.33
Dow Jones U.S. Broker-Dealers Index Fund	1.77%	1.57
Dow Jones U.S. Oil & Gas Exploration & Production Index Fund	1.79%	1.37
Dow Jones U.S. Financial Services Index Fund	1.90%	1.61
Dow Jones U.S. Home Construction Sector Index Fund	2.00%	1.45

$$TR_p = (R_p - R_{rf}) / \beta_p \quad (3)$$

where TR_p is the Treynor ratio for the sector portfolio, R_p is the realized return from the portfolio, R_{rf} is the risk-free rate, $(R_p - R_{rf})$ is the excess return for the sector portfolio, and β_p is the beta of the portfolio.

In the Sharpe method, a higher Sharpe ratio (SR_p) statistic indicates a better portfolio performance. The SR_p statistic is calculated as follows:

$$SR_p = (R_p - R_{rf}) / \sigma_p \quad (4)$$

where SR_p is the Sharpe ratio for the sector portfolio, R_p is the return from the portfolio, R_{rf} is the risk-free rate, $(R_p - R_{rf})$ is the excess return for the sector portfolio, and σ_p is the standard deviation of the portfolio returns.

When the portfolio excess return is a positive figure, the Treynor and Sharpe ratios show the portfolio excess return per unit of risk. Therefore, in comparisons, the portfolio with the highest excess return per unit of risk has the best performance. However, in a bear market, portfolio excess returns are negative figures. Since beta and standard deviation in the denominator are positive figures, this poses a problem in portfolio performance comparisons. The problem can be dealt with by ranking the excess returns in the numerator from the worst to the best (i.e., assigning number 1 to the index fund with the largest negative excess return, assigning number 2 to the index fund with the second largest negative excess return, etc.) and by ranking the risk measure in the denominator from the lowest to the highest (i.e., assigning number 1 to the index fund with the lowest risk, assigning number 2 to the index fund with the second lowest risk, etc.). The figures obtained by dividing the rank number in the numerator by the rank number in the denominator can be compared to rank order the index funds in terms of performance in a bear market with negative excess returns.

The performance ranking of the 38 sector index funds with the Treynor and Sharpe portfolio performance measures in the October 9, 2007-March 9, 2009 bear market is presented in Table 4. The Dow Jones U.S. Healthcare Sector Index Fund has the best performance with both methods. The healthcare and consumer staples sector funds, which had relatively less losses and low return volatility during the bear market, generally have high performance rankings. Since the recession and the bear market were basically caused by a financial crisis, as would be expected, the financial sector funds have the lowest performance rankings. The financial crisis was triggered by a sub-prime mortgage market crisis and declining real estate values. Therefore, the performance of the Dow Jones U.S. Home Construction Sector Index Fund is also poor and it is ranked 32nd right before the six financial sector index funds, which have the worst performance.

PORTFOLIO DIVERSIFICATION

Exchange-traded sector index funds are good portfolio diversification opportunities. However, their portfolio diversification benefit may be limited in a bear market when all sector fund returns are falling and highly correlated. In this section of the paper, we study the portfolio diversification benefits of the 38 Ishares sector index funds with the Principal Components Analysis (PCA) technique during the October 9, 2007-March 9, 2009 bear market.

PCA is a multivariate method widely used in evaluating the portfolio diversification prospects of global stock markets (see, e.g., Meric et al., 2005, 2006, and 2008). In this technique, the correlation matrix of investment returns is used as an input

Table 4. Rank Ordering the Sector Index Funds with the Sharpe and Treynor Portfolio Performance Measures: October 9, 2007-March 9, 2009

Sector Index Funds	Sharpe Rank	Treynor Rank
Dow Jones U.S. Healthcare Sector Index Fund	1	1
Dow Jones U.S. Consumer Goods Sector Index Fund	2	5
Dow Jones U.S. Pharmaceuticals Index Fund	3	2

S&P 500 Global Consumer Staples Sector Index Fund	4	3
S&P 500 Global Healthcare Sector Index Fund	5	7
NASDAQ Biotechnology Index Fund	6	4
Dow Jones U.S. Medical Devices Index Fund	7	8
Dow Jones U.S. Utilities Sector Index Fund	8	6
Dow Jones U.S. Consumer Services Sector Index Fund	9	12
S&P 500 North American Technology-Software Index Fund	10	13
S&P 500 Global Utilities Sector Index Fund	11	9
S&P 500 North American Technology Sector Index Fund	12	17
S&P 500 Global Telecommunications Sector Index Fund	13	11
Dow Jones U.S. Technology Sector Index Fund	14	15
Dow Jones U.S. Aerospace & Defense Index Fund	15	18
S&P 500 Global Technology Sector Index Fund	16	19
S&P 500 Global Energy Sector Index Fund	17	16
Dow Jones U.S. Healthcare Providers Index Fund	18	10
Dow Jones U.S. Energy Sector Index Fund	19	20
S&P 500 Global Consumer Discretionary Sector Index Fund	20	14
S&P 500 North American Natural Resources Sector Index Fund	21	22
Dow Jones U.S. Transportation Average Index Fund	22	21
Dow Jones U.S. Industrials Sector Index Fund	23	25
Dow Jones U.S. Telecommunications Sector Index Fund	24	24
Dow Jones U.S. Oil & Gas Exploration & Production Index Fund	25	23
S&P 500 North American Technology-Semiconductors Index Fund	26	26
S&P 500 Global Materials Sector Index Fund	27	27
S&P 500 Global Industrials Sector Index Fund	28	28
Dow Jones U.S. Basic Materials Sector Index Fund	29	29
S&P 500 North American Technology-Multimedia Networking Index Fund	30	30
Dow Jones U.S. Oil Equipment & Services Index Fund	31	31
Dow Jones U.S. Home Construction Sector Index Fund	32	32
Dow Jones U.S. Broker-Dealers Index Fund	33	33
Dow Jones U.S. Regional Banks Index Fund	34	34
Dow Jones U.S. Insurance Index Fund	35	35
Dow Jones U.S. Insurance Index Fund	36	36
S&P 500 Global Financial Sector Index Fund	37	37
Dow Jones U.S. Financial Services Index Fund	38	38

in a PCA computer program and the statistically significant principal components with eigen values greater than unity are extracted. The technique clusters the investments into principal components in terms of the similarities of their return movements. The investments clustered in the same principal component are closely correlated and having these investments in the same portfolio would provide a minimal diversification
benefit. Investors should have investments with high factor loadings in different principal components to maximize the portfolio diversification benefit.

We use the correlation matrix of the 38 sector index funds as an input in the PCA computer program to extract the statistically significant principal components with eigen values greater than one for the October 9, 2007-March 9, 2009 bear market period. The analysis yields three statistically significant principal components. The factor loadings of the three principal components are presented in Table 5.

The first principal component is the most important principal component with an eigen value of 29.26. It explains 76.99 percent of the variation in the original data matrix. The financial sector index funds dominate this principal component. The technology sector index funds, most industrial sector index funds, and most consumer staples sector index funds also have high factor loadings in this principal component. It indicates that the financial sector index funds, the technology sector index funds, most industrial sector index funds, and most consumer staples sector index funds are highly correlated and having them in the same portfolio would provide a limited diversification benefit. To maximize the portfolio diversification benefit, investors should invest in sector index funds with high factor loadings in different principal components

The second principal component has an eigen value of 2.5 and it explains 6.59 percent of the variation in the original data matrix. The energy sector index funds and the materials sector index funds have their highest factor loadings in this principal component. It indicates that the energy sector index funds and the materials sector index funds are highly correlated and having them in the same portfolio would provide a limited diversification benefit. To maximize the portfolio diversification benefit, along with an energy sector fund or a materials sector fund with a high factor loading in the second principal component, investors should select a fund with a high factor loading in the first principal component and a fund with a high factor loading in the third principal component.

The third principal component has an eigen value of 1.28 and it explains 3.36 percent of the variation in the original data matrix. The three principal components together can explain 86.94 percent of the variation in the original data matrix. The health sector index funds have their highest factor loadings in the third principal component. It implies that investors could obtain the greatest portfolio diversification benefit by investing in a health sector index fund and in two other sector index funds with high factor loadings in the first and second principal components.

SUMMARY AND CONCLUSIONS

In this paper, we have compared the performances of 38 Ishares sector index funds using the Sharpe and Treynor portfolio performance measures during the October 9, 2007-March 9, 2009 bear market. Our findings indicate that the healthcare and consumer staples sector index funds had the best performance with relatively smaller losses and less return volatility, and the financials and home construction sector index funds had the worst performance with relatively larger losses and greater return volatility, compared with other funds, during this period.

Table 5. Factor Loadings of the Principal Components

Sector Indexes	Principal Components		
	Prin Comp #1	Prin Comp #2	Prin Comp #3
Dow Jones U.S. Financial Services Index Fund	0.874		
Dow Jones U.S. Regional Banks Index Fund	0.873		
Dow Jones U.S. Financial Sector Index Fund	0.863		
Dow Jones U.S. Home Construction Sector Index Fund	0.818		
Dow Jones U.S. Broker-Dealers Index Fund	0.811		
S&P 500 Global Financial Sector Index Fund	0.762		
Dow Jones U.S. Transportation Average Index Fund	0.725		
Dow Jones U.S. Consumer Services Sector Index Fund	0.693		
Dow Jones U.S. Insurance Index Fund	0.680		
Dow Jones U.S. Industrials Sector Index Fund	0.672		

S&P 500 North Amer Tech-Semiconductors Index Fund	0.653		
S&P 500 North American Tech Sector Index Fund	0.652		
Dow Jones U.S. Technology Sector Index Fund	0.637		
S&P 500 N Amer Tech-Multimedia Net Index Fund	0.635		
S&P 500 Global Technology Sector Index Fund	0.633		
S&P 500 North Amer Technology-Software Index Fund	0.622		
S&P 500 Global Consumer Discr Sector Index Fund	0.614		
Dow Jones U.S. Telecommunications Sector Index Fund	0586		
Dow Jones U.S. Aerospace & Defense Index Fund	0.557		
S&P 500 North Amer Natural Res Sector Index Fund		0.895	
Dow Jones U.S. Oil & Gas Explor & Prod Index Fund		0.883	
Dow Jones U.S. Oil Equipment & Services Index Fund		0.870	
Dow Jones U.S. Energy Sector Index Fund		0.859	
S&P 500 Global Energy Sector Index Fund		0.846	
Dow Jones U.S. Basic Materials Sector Index Fund		0.797	
S&P 500 Global Materials Sector Index Fund		0.796	
S&P 500 Global Industrials Sector Index Fund		0.612	
Dow Jones U.S. Utilities Sector Index Fund		0.609	
S&P 500 Global Telecommunications Sector Index Fund		0.564	
Dow Jones U.S. Healthcare Sector Index Fund			0.804
Dow Jones U.S. Pharmaceuticals Index Fund			0.757
Dow Jones U.S. Healthcare Providers Index Fund			0.746
S&P 500 Global Healthcare Sector Index Fund			0.743
Dow Jones U.S. Medical Devices Index Fund			0.695
NASDAQ Biotechnology Index Fund			0.677
S&P 500 Global Consumer Staples Sector Index Fund			0.640
Dow Jones U.S. Consumer Goods Sector Index Fund			0.639
S&P 500 Global Utilities Sector Index Fund			0.627
Eigen Value	29.26	2.50	1.28
Variance Explained	76.99	6.59	3.36
Cumulative Variance Explained	76.99	83.58	86.94

The Principal Components Analysis (PCA) multivariate technique yields three statistically significant principal components for the October 9, 2007-March 9, 2009 bear market period. The financial sector index funds, the technology sector index funds, most industrial sector index funds, and most consumer staples sector index funds have their highest factor loadings in the first principal component. The energy index funds and the materials index funds have their highest factor loadings in the second principal component. The healthcare index funds have their highest factor loadings in the third principal component. Funds with high factor loadings in the same principal component are highly correlated and having them in the same portfolio would provide a limited diversification benefit. Investors could have maximized the portfolio diversification benefit by investing in funds with high factor loadings in different principal components during the October 9, 2007-March 9, 2009 bear market.

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