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Modern portfolio diversification using iShares: correlation and return gaps

Abstract

This analysis shows that coefficient of correlation alone does not provide an intuitive indicator of diversification benefits nor do these benefits depend only on the correlation between asset returns. Using domestic, international, industry-specific, commodity and bond iShares, this study demonstrates that a return gap accounts for the effects of both correlations and standard deviation, and provides a perceptive measure of diversification benefits. It shows that relative rank of assets by diversification benefits is different when measured by correlation coefficient and by return gap. Therefore, investors seeking diversification opportunities could combine coefficient of correlation and return gap in practical asset allocation.

Keywords: diversification, correlation, return.
JEL Classification: G11, G15.

Introduction

Portfolio risk can be reduced to a substantial extent with a sensible mix of financial assets. This is what mean-variance model of portfolio selection proposed, developed, and justified by the pioneers of portfolio diversification – Harry Markowitz (1959) and James Tobin (1958). This model precisely suggests the nature of co-movement among the security returns is the important variable that influences scope of portfolio risk reduction; however, as diversification increases, risk of the portfolio decreases but not proportionally. Furthermore, portfolio risk can never be eliminated completely even with a very large number of stocks because there is a strong tendency among stocks within an economy to move more or less in unison (e.g., Bernstein and Pinkernell, 2006; 2007).

Previous empirical findings show that investors seeking diversification may benefit form being able to at least partially hedge out market exposure through investing in regions, countries (e.g., Grubel, 1968; Levy and Sarnat, 1970; Heston and Rouwenhorst, 1994; Bekaert and Harvey, 1995; Bekaert et al, 1996; Griffin and Karolyi, 1998; Cavaglia et al., 2000; Serra, 2000; Diermeier and Solnik; 2001, Li et al., 2003; Meyer and Rose, 2003; Driessen and Leaven, 2007) and across different asset classes (e.g., Bernstein and Pinkernell, 2007; Statman and Scheid, 2008).

While correlation is the common indicator of diversification benefits, Statman and Scheid (2008) point out that coefficient of correlation alone does not provide an intuitive indicator of diversification benefits nor these benefits depend only on the correlation between asset returns. Authors show that portfolio diversification also depends on the standard deviation of asset returns and introduce return gap. A return gap is a gap between the returns of a pair of assets, whether U.S. equity and international equity or other asset categories. The return gap and the diversification benefits are lower when correlation is higher, but the return gap is higher when standard deviation is higher.

The purpose of this study is to explore the differences between correlation and the return gap as a measure of diversification benefits and show that diversification benefits across different asset classes remain considerable on example of iShares – one of the fastest-growing exchange-traded funds (ETFs) family that combines key features of traditional mutual funds and individual stocks in the financial markets since early 1990s.

The remainder of the paper is organized as follows. Section 1 summarizes the methodology and data used in this study. Section 2 presents the empirical results. The final section offers some concluding remarks.

1. Data and methodology

The return gap is associated with dispersion – standard deviation of an individual asset return around the mean return of all assets. In the case of two assets, dispersion can be defined as the difference between the return of each asset and the mean return of these two assets.

Solnik and Roulet (2000) present correlation as a function of dispersion and the standard deviation of the returns of a market portfolio. They introduce and test the concept of cross-sectional dispersion of stock market returns as an alternative and instantaneous measure of the general level of global market correlation. They demonstrate usefulness of dispersion to measure integration of global equity markets and find that equity markets become more integrated but at a slower pace than is proposed by prac-

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titioners. These findings are consistent with Solnik et al. (1996) results, who stress that growth of new markets partly offsets the trend toward increasing correlation between international markets.

Statman and Scheid (2005) present dispersion as a function of correlations and standard deviation of individual assets. Statman and Scheid (2008) apply similar approach to an individual asset and global market portfolio. Their analysis shows that the benefits of diversification during down markets are higher compared to up markets between 1926 and 2007. Using Statman and Scheid (2008) approach, Realized Return Gap is calculated on the example of two assets as:

$$Realized\ Return\ Gap = 2\sigma\sqrt{\frac{(1-\rho)}{2}}, \quad (1)$$

where σ – mean standard deviation of asset returns and ρ – correlation between two assets. The return gap between the two assets is double the dispersion.

Return gap and diversification benefits are lower when correlation between assets is higher; however, return gap and diversification benefits are higher when standard deviation is higher between a pair of assets. Statman and Scheid (2008) warn against confusing a return gap and covariance. Both of them combine correlation and standard deviation; however, these two functions are different. Covariance and the return gap are higher when the standard deviation is higher. On the other hand, covariance is lower when correlation coefficient is lower but the return gap and diversification benefits are higher.

Bernstein and Pinkernell (2007) find that diversification benefits diminish over the years. However, their conclusion is challenged by Statman and Scheid (2008), who demonstrate that diversification benefits remain substantial when measured by return gap instead of coefficient of correlation only. They reveal that negative effects of an increase in correlation on the benefits of diversification are often mitigated by a simultaneous increase in standard deviation.

I collect monthly data for iShares representing 22 broad asset classes which include US broad equity market (iShares Russell 3000, iShares Russell 2000, iShares Russell Midcap, iShares S&P 1500, iShares S&P 500, iShares S&P Midcap, iShares S&P Small Cap 600), US industry-specific equity (iShares DJ US Basic Materials, iShares DJ US Consumer Goods, iShares DJ US Consumer Services, iShares DJ US Energy, iShares DJ US Financial Sector, iShares DJ US Technology Sector, iShares DJ US Telecommunications Sector), international equity (iShares MSCI EAFE, iShares MSCI Emerging Markets, iShares S&P Latin America 40), real estate (iShares Cohen&Street Realty Majors, iShares DJ US Real Estate), US Treasury and investment grade corporate bonds (iShares Barclays US Multisector Aggregate Bond fund), and commodities (iShares S&P Goldman Sachs Commodity Index fund) between March 2001 and March 2011. Table 1 presents sample of iShares.

In 2009, US exchange-traded product assets – iShares – grew at a 46% growth rate, with net inflows of $115 billion. As of 2010, iShares command 46% of the US ETF industry, offer more than 440 funds – $480 billion in assets under management[1]. The iShares family of ETFs is built around virtually every leading market index provider: Barclays Capital, Cohen & Steers, Dow Jones, JP Morgan, FTSE, MSCI, NASDAQ, Morningstar, NYSE, Russell and Standards and Poor's. iShares ETFs are diversified like index funds, seek to track specific market indexes; however, trade like a stock. Listed on all major stock exchanges (e.g., NYSE, AMEX, NASDAQ), they offer advantages of transparency, cost- and tax-efficiency, index exposure, and continuous pricing just like shares of publicly held company. They can be traded any time during normal trading hours, using all the trading strategies associated with stocks. Investors can pursue a variety of short-term and long-term investment strategies (e.g., equitizing, dividend investment, portfolio completion, tax-loss harvesting, investment selection through rebalancing and asset allocation, seeking "alpha") utilizing iShares. Simply put, the broad family of iShares ETFs makes diversification easy both across a variety of asset classes and across a range of geographies, sector funds, and styles, with low-cost, efficient funds tracking established indexes in virtually every asset class and category.

2. Empirical findings

Table 2 shows descriptive statistics for the sample of iShares. Over the sample period, iShares DJ US Energy Sector, iShares Cohen & Street Realty Majors, iShares DJ US Real Estate, iShares MSCI Emerging Markets, and iShares S&P Latin America 40 generated the highest average monthly rate of return (1.10%, 1.19%, 1.06%, 1.88%, and 2.17%). At the same time, these ETFs have exhibited the highest volatility of their returns (6.27%, 7.72%, 7.05%, 6.99%, and 7.93%) along with iShares S&P GSCI (7.99%) and iShares DJ US Technology sector (7.79%).

Next, I create four portfolios. Each portfolio has exposure to broad US market, international equity, real estate, US Treasury and investment grade corporate bonds, and commodities. Table 3 (Panel A

[1] http://www.iShares.com.

through Panel D) presents correlation coefficient between 17 (Panel A and B) and 18 (Panel C and D) asset classes. Results presented in Table 3 show that iShares DJ US Real Estate, iShares Cohen & Street Realty, iShares S&P Latin America 40, iShares S&P GSCI Commodity Indexed Trust, and iShares Barclays US Multisector Aggregate Bond Fund exhibit the lowest correlation with broad and sector-specific US equity and international equity markets. Higher correlations are undeniably associated with lower benefits of diversification, but relations between the two are far from perfect since standard deviation plays a role as well. For example, the correlation coefficient between iShares Russell 3000 and iShares Russell MidCap is 0.957 almost identical to the correlation between iShares S&P 1500 and iShares S&P MidCap (0.962). However, the benefits of diversification of two pairs of assets are quite different based on the realized return gap. The realized return gap for the first pair of assets is 7.4110% vs. 5.1444% for the later pair. Over the same period, correlation coefficient between iShares S&P 1500 and iShares S&P 500 is almost one (0.999) and realized return gap is less than one percent (0.2115%). Observation of realized return gap shows that diversification provided smaller benefits in this case. Investors should carefully consider portfolio composition when making their investment decisions. iShares S&P 1500 and iShares S&P 500 top 10 holdings are almost identical (companies and their weights in corresponding index funds).

Figure 1 (Panel A through F) shows some examples of correlation and realized monthly return gaps between asset classes for the sample period. Panels B, C, E, and F demonstrate the most striking picture.

Results presented in Table 4 show that the benefits of diversification rank of asset pairs by correlation coefficient often differs from their rank based on realized return gap. For example, the (0.245) correlation between iShares Barclays US Multisector Aggregate Bond Fund and iShares DJ US Real Estate places this pair of assets first on benefits of diversification when ranked by correlation, but the pair's 107.7538% return gap places it only 47th when ranked by return gap. In fact, findings presented in Table 4, illustrate the importance of considering standard deviation along with coefficient of correlation when assessing diversification benefits across asset categories. Moreover, these results show that despite of increase within the US market, sector, industry and global market correlations the potential for further risk reduction through asset allocation and international diversification remains quite considerable.

Conclusion

Coefficient of correlation is the frequent indicator of portfolio diversification benefits; however, correlation alone does not offer an intuitive gauge of diversification benefits nor do these benefits depend only on the correlation between asset return. Findings of this study show that relative order of assets by diversification benefits is different when measured by correlation coefficient and by return gap. Furthermore, investors seeking portfolio diversification opportunities could combine coefficient of correlation and return gap in practical asset allocation to at least partially hedge out market exposure and invest more granularly in sectors, regions, countries, and asset categories.

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Appendix

Table 1. Sample of iShares

iShares	Ticker	iShares	Ticker
iShares Russell 3000	IWV	iShares DJ US Utilities Sector	IDU
iShares Russell MidCap	IWR	iShares S&P 1500	ISI
iShares Russell 2000	IWM	iShares S&P MidCap	IJH
iShares DJ US Basic Materials Sector	IYM	iShares S&P SmallCap 600	IJR
iShares DJ US Consumer Goods Sector	IYK	iShares S&P 500	IVV
iShares DJ US Consumer Services Sector	IYC	iShares MSCI EAFE	EFA
iShares DJ US Energy Sector	IYE	iShares MSCI Emerging Markets	EEM
iShares DJ US Financial Sector	IYF	iShares S&P Latin America 40	ILF
iShares DJ US Technology Sector	IYW	iShares Barclays US Multisector Aggregate Bond Fund	AGG
iShares DJ US Telecommunications Sector	IYZ	iShares S&P GSCI* Commodity-Indexed Trust	GSG
iShares Cohen & Street Realty Majors	ICF	iShares DJ US Real Estate	IYR

Table 2. Descriptive statistics

iShares ticker	Number of monthly observations	Min, %	Max, %	Mean, %	Std. dev, %
IWV	121	-17.69	10.50	0.38	4.74
IWR	116	-22.32	15.32	0.79	5.39
IWM	121	-20.76	15.43	0.76	6.03
IYM	121	-25.87	17.89	1.03	6.93
IYK	121	-14.87	9.21	0.59	3.69
IYC	121	-16.74	13.06	0.35	5.25
IYE	121	-19.27	16.90	1.10	6.27
IYF	121	-23.90	19.90	0.11	6.29
IYW	121	-21.71	22.04	0.39	7.79
IYZ	121	-20.81	28.76	0.002	6.52
ICF	121	-33.18	33.59	1.19	7.72
IYR	121	-31.20	29.52	1.06	7.05
IDU	121	-12.77	10.16	0.35	4.43
ISI	86	-17.30	10.21	0.49	4.53
IJH	121	-21.68	14.82	0.81	5.36
IJR	121	-20.00	17.00	0.85	5.76
IVV	121	-16.76	9.55	0.32	4.62
EFA	115	-20.11	12.78	0.64	5.31
EEM	95	-25.7	16.0	1.88	6.99
ILF	113	-31.60	20.37	2.17	7.93
AGG	92	-2.67	3.96	0.39	1.04
GSG	57	-27.77	19.52	0.005	7.99

Table 3. Correlation among iShares

Panel A																		
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG	GSG
IWV	1																	
IWR	0.971	1																
IWM	0.919	0.957	1															
IYM	0.866	0.881	0.802	1														
IYK	0.817	0.800	0.760	0.694	1													
IYC	0.924	0.918	0.892	0.787	0.737	1												
IYE	0.653	0.672	0.595	0.706	0.507	0.480	1											
IYF	0.862	0.831	0.807	0.704	0.766	0.808	0.413	1										
IYW	0.865	0.838	0.801	0.704	0.565	0.808	0.500	0.624	1									
IYZ	0.764	0.701	0.627	0.614	0.571	0.681	0.485	0.599	0.663	1								
IDU	0.653	0.664	0.600	0.563	0.586	0.508	0.666	0.475	0.481	0.556	1							
ICF	0.678	0.738	0.720	0.621	0.618	0.640	0.353	0.784	0.445	0.394	0.421	1						
EFA	0.897	0.886	0.819	0.851	0.794	0.764	0.711	0.787	0.715	0.651	0.703	0.654	1					
EEM	0.835	0.839	0.781	0.857	0.707	0.690	0.716	0.667	0.771	0.678	0.618	0.610	0.902	1				
EZU	0.894	0.872	0.804	0.819	0.757	0.773	0.666	0.772	0.749	0.689	0.669	0.611	0.966	0.861	1			
ILF	0.792	0.788	0.709	0.798	0.671	0.664	0.716	0.628	0.660	0.665	0.662	0.531	0.834	0.922	0.803	1		
AGG	-0.177	-0.207	-0.191	-0.127	-0.199	-0.192	-0.167	-0.183	-0.089	-0.037	-0.055	-0.242	-0.147	-0.119	-0.103	-0.153	1	
GSG	0.352	0.398	0.295	0.487	0.259	0.333	0.333	0.321	0.292	0.320	0.233	0.323	0.378	0.380	0.331	0.449	-0.233	1

Table 3 (cont.). Correlation among iShares

Panel B																		
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG	GSG
IWV	1																	
IWR	0.971	1																
IWM	0.919	0.957	1															
IYM	0.866	0.881	0.802	1														
IYK	0.817	0.800	0.760	0.694	1													
IYC	0.924	0.918	0.892	0.787	0.737	1												
IYE	0.653	0.672	0.595	0.706	0.507	0.480	1											
IYF	0.862	0.831	0.807	0.704	0.766	0.808	0.413	1										
IYW	0.865	0.838	0.801	0.704	0.565	0.808	0.500	0.624	1									
IYZ	0.764	0.701	0.627	0.614	0.571	0.681	0.485	0.599	0.663	1								
IDU	0.653	0.664	0.600	0.563	0.586	0.508	0.666	0.475	0.481	0.556	1							
IYR	0.709	0.768	0.754	0.646	0.645	0.675	0.367	0.808	0.473	0.421	0.421	1						
EFA	0.897	0.886	0.819	0.851	0.794	0.764	0.711	0.787	0.715	0.651	0.703	0.676	1					
EEM	0.835	0.839	0.781	0.857	0.707	0.690	0.716	0.667	0.771	0.678	0.618	0.633	0.902	1				
EZU	0.894	0.872	0.804	0.819	0.757	0.773	0.666	0.772	0.749	0.689	0.669	0.632	0.966	0.861	1			
ILF	0.792	0.788	0.709	0.798	0.671	0.664	0.716	0.628	0.660	0.665	0.662	0.557	0.834	0.922	0.803	1		
AGG	-0.177	-0.207	-0.191	-0.127	-0.199	-0.192	-0.167	-0.183	-0.089	-0.037	-0.055	-0.245	-0.147	-0.119	-0.103	-0.153	1	
GSG	0.352	0.398	0.295	0.487	0.259	0.333	0.333	0.321	0.292	0.320	0.233	0.329	0.378	0.380	0.331	0.449	-0.233	1

Table 3 (cont.). Correlation among iShares

Panel C																			
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG	GSG
ISI	1																		
IVV	0.999	1																	
IJH	0.962	0.934	1																
IJR	0.927	0.876	0.960	1															
IYM	0.880	0.857	0.868	0.800	1														
IYK	0.888	0.816	0.779	0.765	0.694	1													
IYC	0.921	0.915	0.917	0.890	0.787	0.737	1												
IYE	0.667	0.649	0.669	0.601	0.706	0.507	0.480	1											
IYF	0.877	0.864	0.803	0.807	0.704	0.766	0.808	0.413	1										
IYW	0.886	0.860	0.827	0.765	0.704	0.565	0.808	0.500	0.624	1									
IYZ	0.791	0.775	0.673	0.604	0.614	0.571	0.681	0.485	0.599	0.663	1								
IDU	0.672	0.648	0.644	0.579	0.563	0.586	0.508	0.666	0.475	0.481	0.556	1							
ICF	0.777	0.656	0.705	0.730	0.621	0.618	0.640	0.353	0.784	0.445	0.394	0.421	1						
EFA	0.901	0.895	0.864	0.808	0.851	0.794	0.764	0.711	0.787	0.715	0.651	0.703	0.654	1					
EEM	0.827	0.827	0.826	0.772	0.857	0.707	0.690	0.716	0.667	0.771	0.678	0.618	0.610	0.902	1				
EZU	0.893	0.896	0.843	0.796	0.819	0.757	0.773	0.666	0.772	0.749	0.689	0.669	0.611	0.966	0.861	1			
ILF	0.801	0.686	0.738	0.762	0.646	0.645	0.675	0.367	0.628	0.473	0.421	0.448	0.531	0.676	0.922	0.803	1		
AGG	-0.193	-0.169	-0.206	-0.202	-0.127	-0.199	-0.192	-0.167	-0.183	-0.089	-0.037	-0.055	-0.242	-0.147	-0.119	-0.103	-0.153	1	
GSG	0.349	0.343	0.392	0.306	0.487	0.260	0.333	0.333	0.321	0.292	0.321	0.233	0.323	0.378	0.380	0.331	0.449	-0.233	1

Table 3 (cont.). Correlation among iShares

Panel D																			
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG	GSG
ISI	1																		
IVV	0.999	1																	
IJH	0.962	0.934	1																
IJR	0.927	0.876	0.960	1															
IYM	0.880	0.857	0.868	0.800	1														
IYK	0.888	0.816	0.779	0.765	0.694	1													
IYC	0.921	0.915	0.917	0.890	0.787	0.737	1												
IYE	0.667	0.649	0.669	0.601	0.706	0.507	0.480	1											
IYF	0.877	0.864	0.803	0.807	0.704	0.766	0.808	0.413	1										
IYW	0.886	0.860	0.827	0.765	0.704	0.565	0.808	0.500	0.624	1									
IYZ	0.791	0.775	0.673	0.604	0.614	0.571	0.681	0.485	0.599	0.663	1								
IDU	0.672	0.648	0.644	0.579	0.563	0.586	0.508	0.666	0.475	0.481	0.556	1							
IYR	0.801	0.686	0.738	0.762	0.646	0.645	0.675	0.367	0.808	0.473	0.421	0.421	1						
EFA	0.901	0.895	0.864	0.808	0.851	0.794	0.764	0.711	0.787	0.715	0.651	0.703	0.676	1					
EEM	0.827	0.827	0.826	0.772	0.857	0.707	0.690	0.716	0.667	0.771	0.678	0.618	0.633	0.902	1				
EZU	0.893	0.896	0.843	0.796	0.819	0.757	0.773	0.666	0.772	0.749	0.689	0.669	0.632	0.966	0.861	1			
ILF	0.801	0.686	0.738	0.762	0.646	0.645	0.675	0.367	0.628	0.473	0.421	0.448	0.557	0.676	0.922	0.803	0.801		
AGG	-0.193	-0.169	-0.206	-0.202	-0.127	-0.199	-0.192	-0.167	-0.183	-0.089	-0.037	-0.055	-0.245	-0.147	-0.119	-0.103	-0.153	1	
GSG	0.349	0.343	0.392	0.306	0.487	0.260	0.333	0.333	0.321	0.292	0.321	0.233	0.329	0.378	0.380	0.331	0.449	-0.233	1

Table 4. Realized return gap

Panel A																	
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG
IWR	7.4110 3.0888- 9.6863																
IWM	33.2785 14.6822- 52.5287	9.9316 0.2148- 13.4794															
IYM	28.0253 5.5412- 36.9138	29.3321 0.0901- 36.8672	51.4209 1.2654- 64.7744														
IYK	53.9535 0.5282- 71.3666	52.0363 0.6770- 61.6125	82.0538 45.7245- 100.1073	92.6885 28.3963- 130.2322													
IYC	15.0622 2.0844- 18.1319	22.4850 0.9386- 29.0567	35.3524 17.0339- 41.8977	56.8019 5.9190- 81.1287	54.3343 22.5792- 71.1979												
IYE	72.2068 9.9244- 84.3830	71.4228 1.3511- 89.4434	98.1172 3.1561- 122.3225	94.3081 30.5023- 106.4191	77.4648 52.7689- 96.6829	117.1848 25.5692- 139.7230											
IYF	51.4207 55.0989- 64.7744	82.0537 66.7715- 100.1073	92.6889 97.2897- 130.2322	166.9254 119.4233- 413.6575	43.4698 34.5425- 147.7579	54.3082 34.7061- 465.2763	225.9841 175.3039- 382.6059										
IYW	26.9081 14.2488- 36.6678	43.4203 6.2186- 63.6576	55.4638 23.6504- 74.7585	95.0657 71.3142- 110.4549	86.9695 72.7209- 111.0607	48.3260 23.1361- 58.6729	142.7629 69.4703- 161.7245	110.6939 114.0127- 149.7049									
IYZ	55.8117 25.4789- 93.4344	85.6437 27.0699- 139.7139	117.9592 59.1909- 156.1405	123.7637 50.7982- 149.9152	74.4621 30.2847- 86.1158	86.0858 35.6193- 128.3073	141.1386 53.9080- 161.4628	110.6467 149.4891- 180.1585	162.9143 0-330.0663								
IDU	74.8547 14.2306- 93.5853	76.5519 1.1127- 90.6091	96.4652 52.4147- 120.6058	135.5838 41.4684- 152.1857	67.2584 54.5926- 77.5583	114.0601 36.9701- 129.0545	78.0297 12.9489- 105.7459	98.1944 48.8213- 353.9545	232.6611 0-310.2598	171.1116 52.1590- 261.7410							
ICF	21.2305 1.3906- 53.5318	28.8655 2.5029- 46.7925	91.2534 38.2099- 108.8179	104.9919 46.9478- 142.1934	62.1117 25.0509- 78.6967	112.1022 76.2361- 139.3048	157.1419 87.6188- 202.7063	65.7883 44.7030- 108.7183	89.6323 64.5891- 130.6269	177.5101 27.1495- 253.1782	104.7553 4.8976- 128.0261						
EFA	19.3870 0.1119- 24.5299	22.8881 16.5488- 30.6008	39.5640 26.5017- 54.4830	41.6368 29.4029- 51.7889	32.6694 24.3639- 41.2203	49.8145 35.7290- 61.8111	78.6977 51.3727- 92.6924	97.5132 58.9751- 58.9751	116.2368 102.9572- 134.5021	72.0333 23.3265- 85.0217	54.3709 4.9750- 65.8142	108.1047 30.7785- 133.8215					

Table 4 (cont.). Realized return gap

Panel A																	
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG
EEM	23.2347 0.3216- 39.1638	27.3930 0.7387- 43.4067	39.7636 1.1229- 66.0672	37.9887 0.6228- 51.9318	42.4069 0.0532- 60.2351	55.2185 1.7601- 89.8306	66.7314 2.4819- 88.9454	128.5426 123.1668- 184.0022	94.5290 24.4179- 126.9217	103.9949 32.7154- 137.2559	68.4548 9.8727- 86.6328	98.4105 17.7898- 150.4181	15.55414 0.1926- 26.0168				
EZU	19.1477 0.5982- 25.7654	22.7598 0.3751- 34.4539	33.0403 0.3726- 49.2326	48.3609 23.8809- 62.6287	44.8015 39.2955- 51.5986	47.3379 34.4550- 59.4519	82.9204 26.4930- 104.7309	90.4294 86.94111- 141.3458	48.1109 33.1630- 71.7215	102.7643 34.6096- 151.0517	61.7184 6.3350- 73.1611	140.9614 37.2296- 158.9277	7.9759 0.6114- 10.2967	33.8307 1.3715- 48.5310			
ILF	33.6184 4.3998- 49.2362	38.5484 2.4225- 57.2114	65.8488 50.0948- 87.8009	69.0813 60.2432- 77.8677	49.9407 27.7793- 61.7253	67.4973 41.2304- 88.1441	85.6349 73.5974- 95.6748	133.5921 153.665- 194.061	65.6531 28.1553- 117.0281	140.9614 37.2296- 158.9277	108.9012 67.8255- 165.6879	130.0650 29.8455- 181.2096	35.9564 16.7873- 44.0529	21.6003 10.1084- 27.3160	430.5784 317.0454- 878.9722		
AGG	140.6272 23.5198- 279.7326	165.7637 21.9564- 325.8627	240.2194 151.0416- 360.5800	248.2695 144.0997- 391.613	149.4700 93.2685- 222.1035	202.6546 118.5225- 312.980	266.6204 190.6336- 365.8344	372.2469 34.4343- 589.4079	228.6318 96.6310- 372.1252	165.4610 5.2342- 339.3807	145.1863 41.7016- 233.6003	228.4187 23.7487- 479.5056	171.0606 40.6226- 304.3016	234.6373 53.4689- 393.0374	195.1662 32.6570- 373.9336	271.3859 56.4555- 458.2154	
GSG	77.3979 0.4579- 153.6993	81.1138 0.2751- 162.2123	103.3058 0.0079- 213.0720	85.5512 0.2092- 177.4597	71.6668 0.3247- 136.7178	86.8600 0.0641- 174.9604	115.2068 0.4874- 209.0054	211.5994 204.2859- 292.1392	107.7538 0.7716- 213.5523	121.2909 22.8212- 222.2250	94.6438 16.4103- 169.8725	137.555 18.1501- 259.5064	85.1943 17.5814- 165.1549	15.1215 0.4582- 289.2652	115.1605 23.3369- 226.7626	117.0571 16.7565- 218.8531	28.8226 4.1316- 54.4938

Table 4 (cont.). Realized return gap

Panel B																	
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG
IWR	7.4110 3.0888- 9.6863																
IWM	33.2785 14.6822- 52.5287	9.9316 0.2148- 13.4794															
IYM	28.0253 5.5412- 36.9138	29.3321 0.0901- 36.8672	51.4209 1.2654- 64.7744														
IYK	53.9535 0.5282- 71.3666	52.0363 0.6770- 61.6125	82.0538 45.7245- 100.1073	92.6885 28.3963- 130.2322													
IYC	15.0622 2.0844- 18.1319	22.4850 0.9386- 29.0567	35.3524 17.0339- 41.8977	56.8019 5.9190- 81.1287	54.3343 22.5792- 71.1979												
IYE	72.2068 9.9244- 84.3830	71.4228 1.3511- 89.4434	98.1172 3.1561- 122.3225	94.3081 30.5023- 106.4191	77.4648 52.7689- 96.6829	117.1848 25.5692- 139.7230											
IYF	51.4207 55.0989- 64.7744	82.0537 66.7715- 100.1073	92.6889 97.2897- 130.2322	166.9254 119.4233- 413.6575	43.4698 34.5425- 147.7579	54.3082 34.7061- 465.2763	225.9841 175.3039- 382.6059										
IYW	26.9081 14.2488- 36.6678	43.4203 6.2186- 63.6576	55.4638 23.6504- 74.7585	95.0657 71.3142- 110.4549	86.9695 72.7209- 111.0607	48.3260 23.1361- 58.6729	142.7629 69.4703- 161.7245	110.6939 114.0127- 149.7049									
IYZ	55.8117 25.4789- 93.4344	85.6437 27.0699- 139.7139	117.9592 59.1909- 156.1405	123.7637 50.7982- 149.9152	74.4621 30.2847- 86.1158	86.0858 35.6193- 128.3073	141.1386 53.9080- 161.4628	110.6467 149.4891- 180.1585	162.9143 0-330.0663								
IDU	74.8547 14.2306- 93.5853	76.5519 1.1127- 90.6091	96.4652 52.4147- 120.6058	135.5838 41.4684- 152.1857	67.2584 54.5926- 77.5583	114.0601 36.9701- 129.0545	78.0297 12.9489- 105.7459	98.1944 48.8213- 353.9545	232.6611 0-310.2598	171.1116 52.1590- 261.7410							
IYR	26.1322 30.0264- 33.3687	71.2305 61.2088- 83.5318	47.8032 52.2669- 59.1661	64.7655 93.8188- 116.6804	37.8686 38.9142- 46.0912	43.3688 44.3527- 53.2693	134.8137 167.8892- 200.2954	65.7883 44.7030- 108.7183	89.6326 111.5095- 130.6269	73.557 113.9247- 126.0332	249.6953 193.7375- 355.6550						
EFA	19.3870 0.1119- 24.5299	22.8881 16.5488- 30.6008	39.5640 26.5017- 54.4830	41.6368 29.4029- 51.7889	32.6694 24.3639- 41.2203	49.8145 35.7290- 61.8111	78.6977 51.3727- 92.6924	97.5132 58.9751- 58.9751	116.2368 102.9572- 134.5021	72.0333 23.3265- 85.0217	54.3709 4.9750- 65.8142	42.3020 62.2595- 66.9734					

Table 4 (cont.). Realized return gap

Panel B																	
	IWV	IWR	IWM	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG
EEM	23.2347 0.3216- 39.1638	27.3930 0.7387- 43.4067	39.7636 1.1229- 66.0672	37.9887 0.6228- 51.9318	42.4069 0.0532- 60.2351	55.2185 1.7601- 89.8306	66.7314 2.4819- 88.9454	128.5426 123.1668- 184.0022	94.5290 24.4179- 126.9217	103.9949 32.7154- 137.2559	68.4548 9.8727- 86.6328	59.1611 91.4361- 104.6749	15.5541 0.1926- 26.0168				
EZU	19.1477 0.5982- 25.7654	22.7598 0.3751- 34.4539	33.0403 0.3726- 49.2326	48.3609 23.8809- 62.6287	44.8015 39.2955- 51.5986	47.3379 34.4550- 59.4519	82.9204 26.4930- 104.7309	90.4294 86.94111- 141.3458	48.1109 33.1630- 71.7215	102.7643 34.6096- 151.0517	61.7184 6.3350- 73.1611	48.1109 65.3274- 71.7215	7.9759 0.6114- 10.2967	33.8307 1.3715- 48.5310			
ILF	33.6184 4.3998- 49.2362	38.5484 2.4225- 57.2114	65.8488 50.0948- 87.8009	69.0813 60.2432- 77.8677	49.9407 27.7793- 61.7253	67.4973 41.2304- 88.1441	85.6349 73.5974- 95.6748	133.5921 153.665- 194.061	65.6531 28.1553- 117.0281	140.9614 37.2296- 158.9277	108.9012 67.8255- 165.6879	65.6531 103.9520- 117.0281	35.9564 16.7873- 44.0529	21.6003 10.1084- 27.3160	430.5784 317.0454- 878.9722		
AGG	140.6272 23.5198- 279.7326	165.7637 21.9564- 325.8627	240.2194 151.0416- 360.5800	248.2695 144.0997- 391.613	149.4700 93.2685- 222.1035	202.6546 118.5225- 312.980	266.6204 190.6336- 365.8344	372.2469 34.4343- 589.4079	228.6318 96.6310- 372.1252	165.4610 5.2342- 339.3807	145.1863 41.7016- 233.6003	107.7538 163.5971- 213.5523	171.0606 40.6226- 304.3016	234.6373 53.4689- 393.0374	195.1662 32.6570- 373.9336	271.3859 56.4555- 458.2154	
GSG	77.3979 0.4579- 153.6993	81.1138 0.2751- 162.2123	103.3058 0.0079- 213.0720	85.5512 0.2092- 177.4597	71.6668 0.3247- 136.7178	86.8600 0.0641- 174.9604	115.2068 0.4874- 209.0054	211.5994 204.2859- 292.1392	107.7538 0.7716- 213.5523	121.2909 22.8212- 222.2250	94.6438 16.4103- 169.8725	81.1138 115.4916- 162.2123	85.1943 17.5814- 165.1549	15.1215 0.4582- 289.2652	115.1605 23.3369- 226.7626	117.0571 16.7565- 218.8531	28.8226 4.1316- 54.4938

Table 4 (cont.). Realized return gap

Panel C																		
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG
IVV	0.2115 0.1236- 0.2761																	
IJH	5.1444 1.7250- 9.3283	19.1441 7.6884- 87.6509																
IJR	12.0589 6.1560- 18.0029	84.4853 64.9751- 109.8982	12.5102 13.5962- 22.8415															
IYM	19.1939 2.6156- 32.5682	57.6338 26.0085- 156.5087	24.5593 25.2894- 49.3101	45.4283 48.1709- 106.6294														
IYK	22.0786 9.4926- 28.7126	37.5315 17.5046- 211.4267	50.5490 43.5883- 93.3685	120.4523 95.1182- 232.4245	92.6885 28.3963- 130.2322													
IYC	13.6609 2.3191- 19.7214	29.5738 17.7202- 78.7826	24.8417 19.043- 37.1484	27.9734 16.7859- 62.7313	56.8019 5.9190- 81.1287	54.3343 22.5792- 71.1979												
IYE	59.3512 4.2806- 82.7974	121.4813 61.1474- 452.6779	100.3933 85.6907- 334.4615	150.7819 109.1977- 490.6122	94.3081 30.5023- 106.4191	77.4648 52.7689- 96.6829	117.1848 25.5692- 139.7230											
IYF	19.1441 6.1877- 30.4325	52.8125 24.9968- 452.6779	70.0115 48.9017- 334.4615	89.3429 38.3694- 490.6122	166.9254 119.4233- 413.6575	43.4698 34.5425- 147.7579	54.3082 34.7061- 465.2763	225.9841 175.3039- 382.6059										
IYW	20.6627 15.7624- 28.0372	33.0794 21.2974- 74.0273	26.1002 25.9731- 40.4039	46.5097 36.0669- 80.4434	95.0657 71.3142- 110.4549	86.9695 72.7209- 111.0607	48.3260 23.1361- 58.6729	142.7629 69.4703- 161.7245	110.6939 114.0127- 149.7049									
IYZ	37.3920 25.3811- 51.5680	58.6059 43.6270- 186.4502	61.8640 57.1983- 145.1727	91.4308 69.6486- 254.8720	123.7637 50.7982- 149.9152	74.4621 30.2847- 86.1158	86.0858 35.6193- 128.3073	141.1386 53.9080- 161.4628	110.6467 149.4891- 180.1585	162.9143 0-330.0663								
IDU	49.2460 8.2404- 81.3917	115.2213 63.6778- 452.6779	97.5252 93.1865- 334.4615	145.1323 109.8449- 490.6122	135.5838 41.4684- 152.1857	67.2584 54.5926- 77.5583	114.0601 36.9701- 129.0545	78.0297 12.9489- 105.7459	98.1944 48.8213- 353.9545	232.6611 0-310.2598	171.1116 52.1590- 261.7410							
ICF	25.8966 26.3273- 55.2016	177.5101 172.3753- 253.1782	65.3916 49.9394- 334.4615	82.3667 32.3569- 490.6122	104.9919 46.9478- 142.1934	62.1117 25.0509- 78.6967	112.1022 76.2361- 139.3048	157.1419 87.6188- 202.7063	65.7883 44.7030- 108.7183	89.6323 64.5891- 130.6269	177.5101 27.1495- 253.1782	104.7553 4.8976- 128.0261						

Table 4 (cont.). Realized return gap

Panel C																		
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	ICF	EFA	EEM	EZU	ILF	AGG
EFA	13.3351 1.1154- 24.4274	43.9298 18.6655- 194.2416	34.9624 30.6339- 81.2836	65.0366 49.4729- 154.7494	41.6368 29.4029- 51.7889	32.6694 24.3639- 41.2203	49.8145 35.7290- 61.8111	78.6977 51.3727- 92.6924	97.5132 58.9751- 58.9751	116.2368 102.9572 -134.5021	72.0333 23.3265- 85.0217	54.3709 4.9750- 65.8142	108.1047 30.7785- 133.8215					
EEM	25.2106 8.4735- 42.7160	79.7497 32.1660 452.6779	62.5853 42.8625- 334.4615	101.9875 62.4399- 490.6122	39.7636 1.1229- 60.0672	42.4069 0.0532- 60.2351	55.2185 1.7601- 89.8306	66.7314 2.4819- 88.9454	128.5426 123.1668 -184.0022	94.5290 24.4179- 126.9217	103.9949 32.7154- 137.2559	68.4548 9.8727- 86.6328	98.4105 17.7898- 150.4181	15.5541 0.1926- 26.0168				
EZU	11.2209 2.1144- 26.5443	33.1766 20.3665- 108.4794	33.1373 34.5767- 63.2156	59.5305 48.0191- 124.8853	48.3609 23.8809- 62.6287	44.8015 39.2955- 51.5986	47.3389 34.4550- 59.4519	82.9204 26.4930- 104.7309	90.4294 86.94111 -141.3458	48.1109 33.1630- 71.7215	102.7643 34.6096- 151.0517	61.7184 6.3350- 73.1611	140.9614 37.2296- 158.9277	7.9759 0.6114- 10.2967	33.8307 1.3715- 48.5310			
ILF	30.2856 7.3175- 55.3688	75.2572 40.7213- 452.6779	65.7701 54.5389- 334.4615	104.3083 82.6549- 490.6122	69.0813 60.2432- 77.8677	49.9407 27.7793- 61.7253	67.4973 41.2304- 88.1441	85.6349 73.5974- 95.6748	133.5921 153.665- 194.061	65.6531 28.1553- 117.0281	140.9614 37.2296- 158.9277	108.9012 67.8255- 165.6879	130.0650 29.8455- 181.2096	35.9564 16.7873- 44.0529	21.6003 10.1084- 27.3160	430.5784 317.0454 -878.9722		
AGG	141.7542 62.3846- 296.2941	283.0904 291.0142 -452.6779	311.8966 408.2221 -459.7737	341.4941 369.6964 -409.6022	248.2695 144.0997 -391.613	149.4700 93.2685- 222.1035	202.6546 118.5225 -312.980	266.6204 190.6336 -365.8344	372.2469 34.4343- 589.4079	228.6318 96.6310- 372.1252	165.4610 5.2342- 339.3807	145.1863 41.7016- 233.6003	228.4187 23.7487- 479.5056	171.0606 40.6226- 304.3016	234.6373 53.4689- 393.0374	195.1662 32.6570- 373.9336	271.3859 56.4555- 458.2154	
GSG	77.5304 16.1759- 161.3771	149.6696 0.1041- 245.9771	153.8369 175.3210- 254.6429	186.6486 182.0787- 486.8832	85.5512 0.2092- 177.4597	71.6668 0.3247- 136.7178	86.8600 0.0641- 174.9604	115.2068 0.4874- 209.0054	211.5994 204.2859 -292.1392	107.7538 0.7716- 213.5523	121.2909 22.8212- 222.2250	94.6438 16.4103- 169.8725	137.555 18.1501- 259.5064	85.1943 17.5814- 165.1549	15.1215 0.4582- 289.2652	115.1605 23.3369- 226.7626	117.0571 16.7565- 218.8531	28.8226 4.1316- 54.4938

Table 4 (cont.). Realized return gap

Panel D																		
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG
IVV	0.2115 0.1236- 0.2761																	
IJH	5.1444 1.7250- 9.3283	19.1441 7.6884- 87.6509																
IJR	12.0589 6.1560- 18.0029	84.4853 64.9751- 109.8982	12.5102 13.5962- 22.8415															
IYM	19.1939 2.6156- 32.5682	57.6338 26.0085- 156.5087	24.5593 25.2894- 49.3101	45.4283 48.1709- 106.6294														
IYK	22.0786 9.4926- 28.7126	37.5315 17.5046- 211.4267	50.5490 43.5883- 93.3685	120.4523 95.1182- 232.4245	92.6885 28.3963- 130.2322													
IYC	13.6609 2.3191- 19.7214	29.5738 17.7202- 78.7826	24.8417 19.043- 37.1484	27.9734 16.7859- 62.7313	56.8019 5.9190- 81.1287	54.3343 22.5792- 71.1979												
IYE	59.3512 4.2806- 82.7974	121.4813 61.1474- 452.6779	100.3933 85.6907- 334.4615	150.7819 109.1977- 490.6122	94.3081 30.5023- 106.4191	77.4648 52.7689- 96.6829	117.1848 25.5692- 139.7230											
IYF	19.1441 6.1877- 30.4325	52.8125 24.9968- 452.6779	70.0115 48.9017- 334.4615	89.3429 38.3694- 490.6122	166.9254 119.4233- 413.6575	43.4698 34.5425- 147.7579	54.3082 34.7061- 465.2763	225.9841 175.3039- 382.6059										
IYW	20.6627 15.7624- 28.0372	33.0794 21.2974- 74.0273	26.1002 25.9731- 40.4039	46.5097 36.0669- 80.4434	95.0657 71.3142- 110.4549	86.9695 72.7209- 111.0607	48.3260 23.1361- 58.6729	142.7629 69.4703- 161.7245	110.6939 114.0127- 149.7049									
IYZ	37.3920 25.3811- 51.5680	58.6059 43.6270- 186.4502	61.8640 57.1983- 145.1727	91.4308 69.6486- 254.8720	123.7637 50.7982- 149.9152	74.4621 30.2847- 86.1158	86.0858 35.6193- 128.3073	141.1386 53.9080- 161.4628	110.6467 149.4891- 180.1585	162.9143 0-330.0663								
IDU	49.2460 8.2404- 81.3917	115.2213 63.6778- 452.6779	97.5252 93.1865- 334.4615	145.1323 109.8449- 490.6122	135.5838 41.4684- 152.1857	67.2584 54.5926- 77.5583	114.0601 36.9701- 129.0545	78.0297 12.9489- 105.7459	98.1944 48.8213- 353.9545	232.6611 0-310.2598	171.1116 52.1590- 261.7410							
IYR	30.2856 7.3175- 55.3688	51.8138 24.4368- 136.9478	70.047 36.0936- 172.3884	122.6423 61.9932- 232-4245	64.7655 93.8188- 116.6804	37.8686 38.9142- 46.0912	43.3688 44.3527- 53.2693	134.8137 167.8892- 200.2954	65.7883 44.7030- 108.7183	89.6326 111.5095- 130.6269	73.557 113.9247- 126.0332	249.6953 193.7375- 355.6550						

Table 4 (cont.). Realized return gap

Panel D																		
	ISI	IVV	IJH	IJR	IYM	IYK	IYC	IYE	IYF	IYW	IYZ	IDU	IYR	EFA	EEM	EZU	ILF	AGG
EFA	13.3351 1.1154- 24.4274	43.9298 18.6655- 194.2416	34.9624 30.6339- 81.2836	65.0366 49.4729- 154.7494	41.6368 29.4029- 51.7889	32.6694 24.3639- 41.2203	49.8145 35.7290- 61.8111	78.6977 51.3727- 92.6924	97.5132 58.9751- 58.9751	116.2368 102.9572- 134.5021	72.0333 23.3265- 85.0217	54.3709 4.9750- 65.8142	42.3020 62.2595- 66.9734					
EEM	25.2106 8.4735- 42.7160	79.7497 32.1660 452.6779	62.5853 42.8625- 334.4615	101.9875 62.4399- 490.6122	39.7636 1.1229- 60.0672	42.4069 0.0532- 60.2351	55.2185 1.7601- 89.8306	66.7314 2.4819- 88.9454	128.5426 123.1668- 184.0022	94.5290 24.4179- 126.9217	103.9949 32.7154- 137.2559	68.4548 9.8727- 86.6328	59.1611 91.4361- 104.6749	15.5541 0.1926- 26.0168				
EZU	11.2209 2.1144- 26.5443	33.1766 20.3665- 108.4794	33.1373 34.5767- 63.2156	59.5305 48.0191- 124.8853	48.3609 23.8809- 62.6287	44.8015 39.2955- 51.5986	47.3389 34.4550- 59.4519	82.9204 26.4930- 104.7309	90.4294 86.94111- 141.3458	48.1109 33.1630- 71.7215	102.7643 34.6096- 151.0517	61.7184 6.3350- 73.1611	48.1109 65.3274- 71.7215	7.9759 0.6114- 10.2967	33.8307 1.3715- 48.5310			
ILF	30.2856 7.3175- 55.3688	75.2572 40.7213- 452.6779	65.7701 54.5389- 334.4615	104.3083 82.6549- 490.6122	69.0813 60.2432- 77.8677	49.9407 27.7793- 61.7253	67.4973 41.2304- 88.1441	85.6349 73.5974- 95.6748	133.5921 153.665- 194.061	65.6531 28.1553- 117.0281	140.9614 37.2296- 158.9277	108.9012 67.8255- 165.6879	65.6531 103.9520- 117.0281	35.9564 16.7873- 44.0529	21.6003 10.1084- 27.3160	430.5784 317.0454- 878.9722		
AGG	141.7542 62.3846- 296.2941	283.0904 291.0142- 452.6779	311.8966 408.2221- 459.7737	341.4941 369.6964- 409.6022	248.2695 144.0997- 391.613	149.4700 93.2685- 222.1035	202.6546 118.5225- 312.980	266.6204 190.6336- 365.8344	372.2469 34.4343- 589.4079	228.6318 96.6310- 372.1252	165.4610 5.2342- 339.3807	145.1863 41.7016- 233.6003	107.7538 163.5971- 213.5523	171.0606 40.6226- 304.3016	234.6373 53.4689- 393.0374	195.1662 32.6570- 373.9336	271.3859 56.4555- 458.2154	
GSG	77.5304 16.1759- 161.3771	149.6696 0.1041- 245.9771	153.8369 175.3210- 254.6429	186.6486 182.0787- 486.8832	85.5512 0.2092- 177.4597	71.6668 0.3247- 136.7178	86.8600 0.0641- 174.9604	115.2068 0.4874- 209.0054	211.5994 204.2859- 292.1392	107.7538 0.7716- 213.5523	121.2909 22.8212- 222.2250	94.6438 16.4103- 169.8725	81.1138 115.4916- 162.2123	85.1943 17.5814- 165.1549	15.1215 0.4582- 289.2652	115.1605 23.3369- 226.7626	117.0571 16.7565- 218.8531	28.8226 4.1316- 54.4938

Note: The top number in each cell is the mean return gap of a pair of assets, the bottom number is the range of realized return gaps.

Panel A

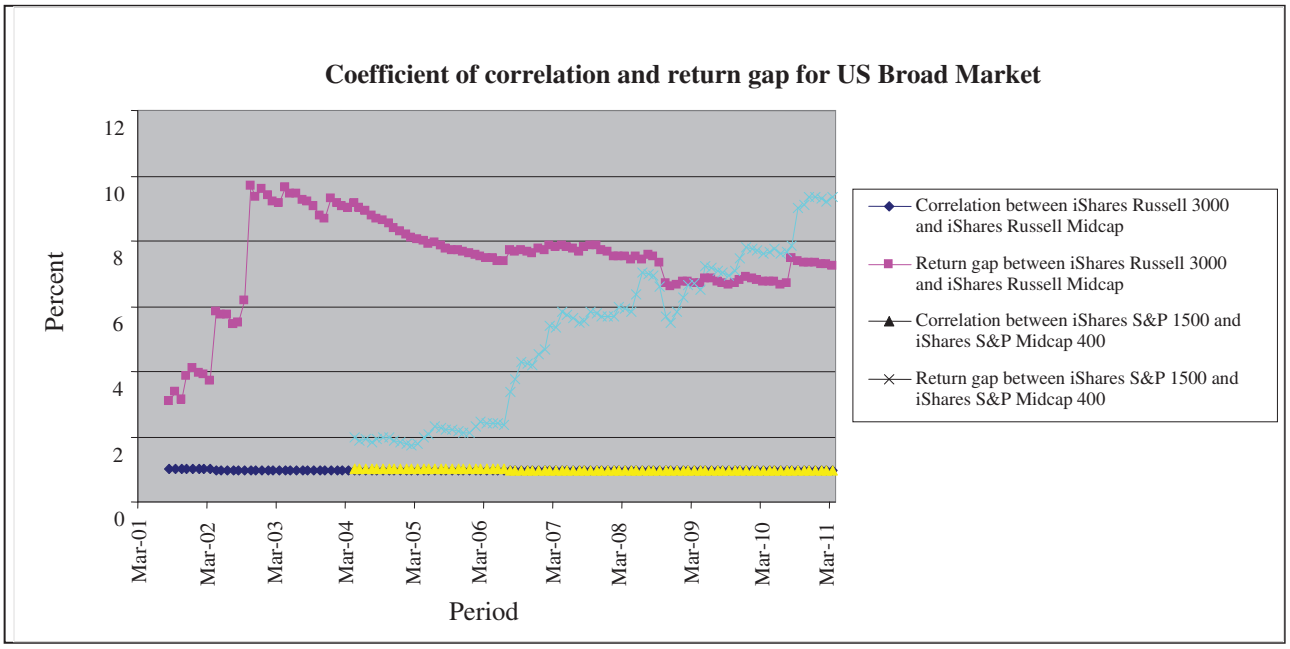


Fig. 1(a). Coefficient of correlation and return gap for US Broad Market

Panel B

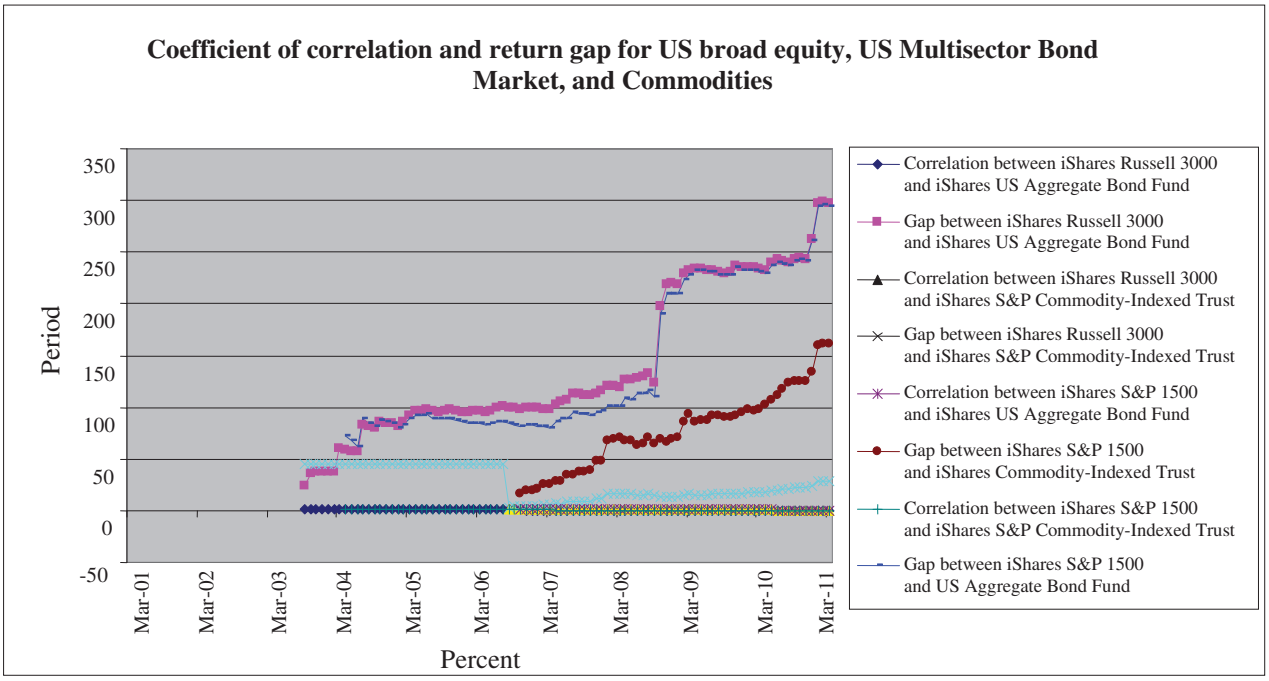


Fig. 1(b). Coefficient of correlation gap for US broad equity, US Multisector Bond Market, and Commodities

Panel C

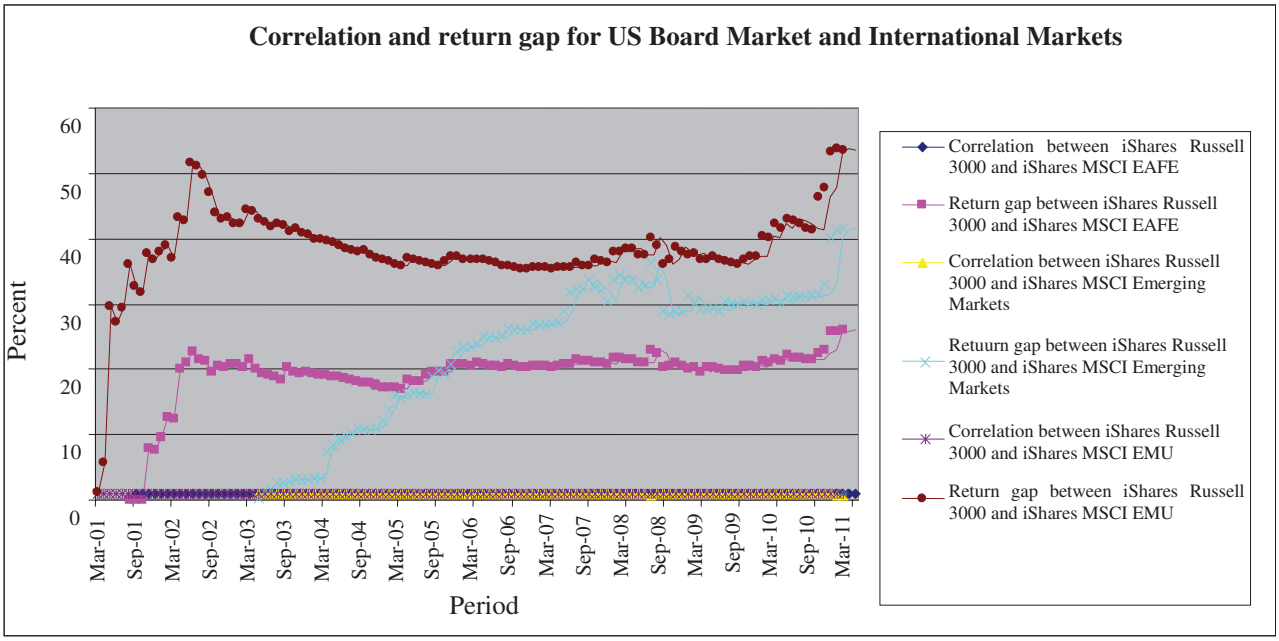


Fig. 1(c). Correlation and return gap for US Board Market and International Markets

Panel D

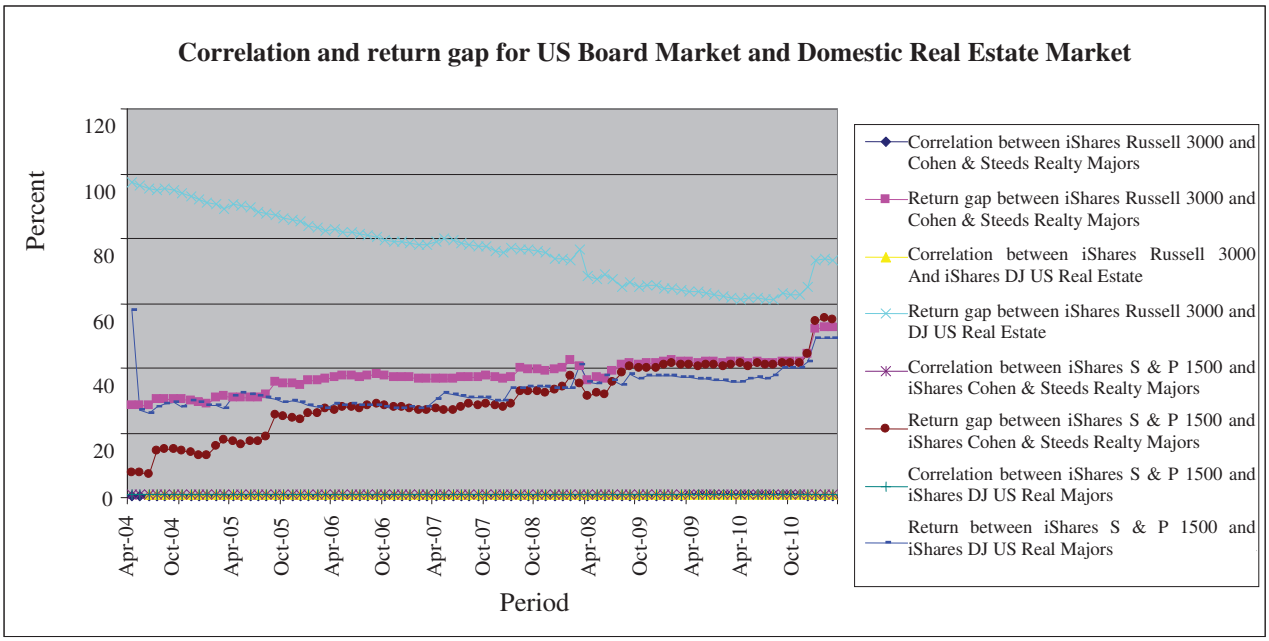


Fig. 1(d). Correlation and return gap for US Board Market and Domestic Real Estate Market

Panel E

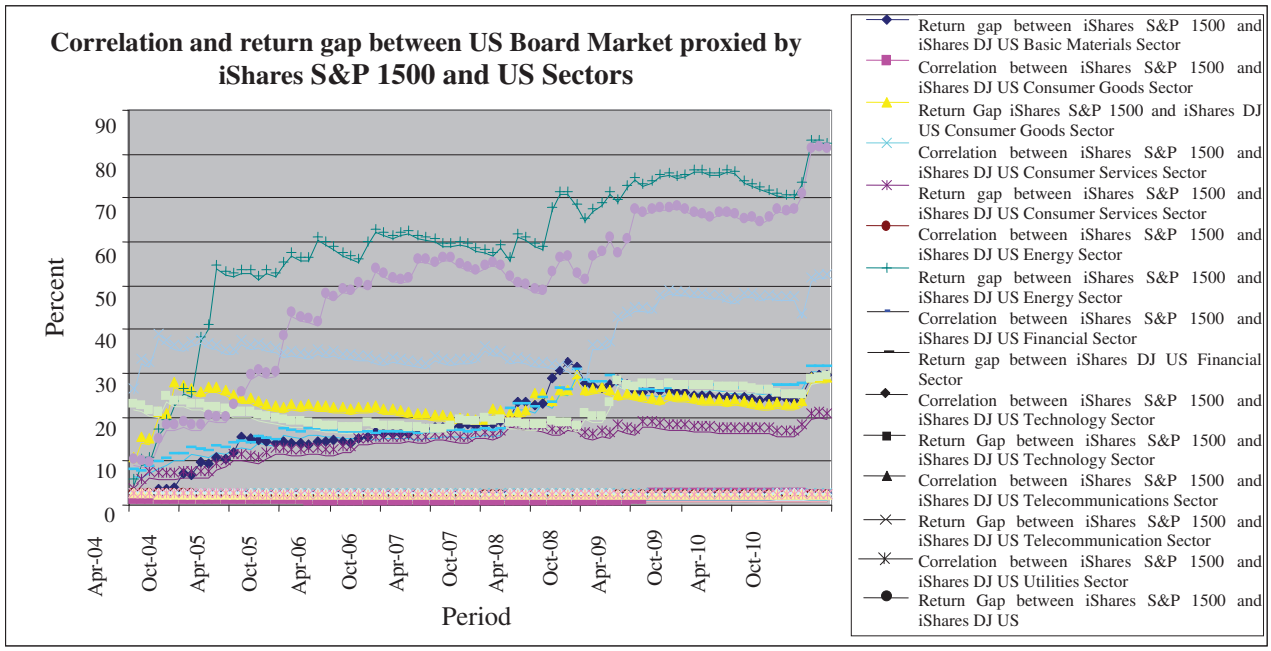


Fig. 1(e). Correlation and return gap between US Broad Market proxied by iShares S&P 1500 and US Sectors

Panel F

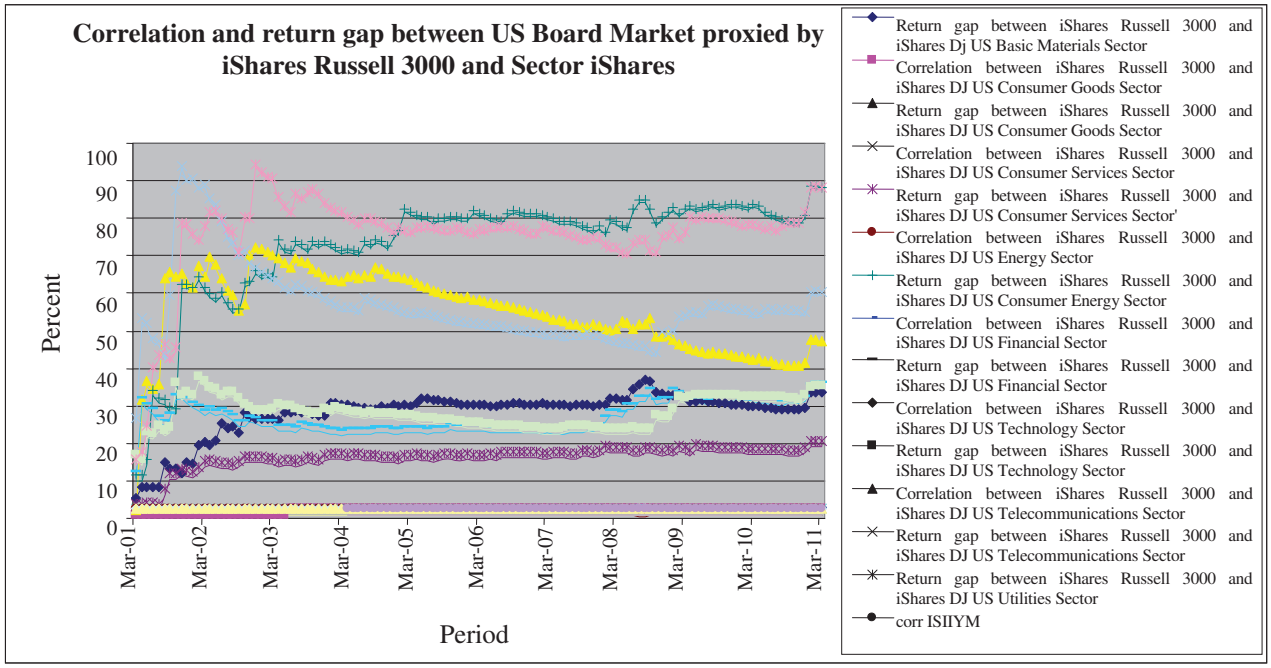


Fig. 1(f). Correlation and return gap between US Board Market proxied by iShares Russell 3000 and Sector iShares