The Cross-Sectional Dispersion of Stock Returns, Alpha and the Information Ratio

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Abstract

Both the cross-sectional dispersion of U.S. stock returns and the VIX provide forecasts of alpha dispersion across high- and low-performing portfolios of stocks that are statistically and economically significant. These findings suggest that absolute return investors can use cross-sectional dispersion and time-series volatility as signals to improve the tactical timing of their alpha-focused strategies. Because active risk increases by a greater amount than alpha, however, high return dispersion/high VIX periods are followed by slightly *lower* information ratio dispersion. Therefore, relative return investors who keep score in an information ratio framework are unlikely to find return dispersion useful as a signal regarding when to increase or decrease the activeness of their portfolio strategies.

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Abstract

Both the cross-sectional dispersion of U.S. stock returns and the VIX provide forecasts of alpha dispersion across high- and low-performing portfolios of stocks that are statistically and economically significant. These findings suggest that absolute return investors can use cross-sectional dispersion and time-series volatility as signals to improve the tactical timing of their alpha-focused strategies. Because active risk increases by a greater amount than alpha, however, high return dispersion/high VIX periods are followed by slightly *lower* information ratio dispersion. Therefore, relative return investors who keep score in an information ratio framework are unlikely to find return dispersion useful as a signal regarding when to increase or decrease the activeness of their portfolio strategies.

The Cross-Sectional Dispersion of Stock Returns, Alpha and the Information Ratio

In recent years a growing literature has emerged that focuses on the performance of active money managers, both in absolute terms and relative to industry benchmarks. The findings of these studies, which are reviewed in the next section, strongly suggest that in the aggregate, professional money managers underperform their benchmarks, and do so with surprising consistency. We provide an additional perspective on the performance of active equity managers by investigating how the dispersion of alpha (the key measure of manager over- and underperformance) changes over time and how performance metrics such as alpha and the information ratio (IR) are affected by changes in the cross-sectional dispersion of equity returns. Cross-sectional dispersion measures the volatility of returns around an index's mean return on the same day, week or month. Gorman, Sapra and Weigand [2010] provide a theoretical framework linking the dispersion of returns to the dispersion of alpha. When the dispersion of alpha is large, the high-conviction stock selections of skilled managers will outperform their benchmark indexes by greater amounts. Therefore, any metric that accurately signals the future dispersion of alpha is valuable to investors.

Our results show that the cross-sectional dispersion of U.S. equity returns provides accurate forecasts of the dispersion of alpha over both 3-month and 1-year horizons. For example, when return dispersion is in its highest quintile (36-90%), it identifies a 160% (annualized) difference in the median alphas of high- and low-performing portfolios of stocks over the next 3 months, vs. a 105% difference when return dispersion is in its lowest quintile. While the 3-month forecasts of the dispersion of alpha are more informative, the magnitude of the alpha dispersion signals over 1-year horizons is also economically significant. When

dispersion is in its highest quintile, the spread between the median alphas for stocks in the 90th vs. 10th alpha percentile over the next year is 74%. This compares to a 53% spread when dispersion is in its lowest quintile.

Our results indicate that return dispersion can be used as an effective alpha dispersion signal for investors whose focus is mainly on either the long or short side, as well as investors pursuing long-short strategies. Moreover, we find that return dispersion and the VIX (a *time-series* oriented volatility measure) are positively correlated, and that the VIX provides similar information regarding the future dispersion of alpha. As reported in greater detail below, investors can observe the VIX at zero cost and infer a forecast of the overall dispersion of equity alpha over the next 3 to 12 months, and use this information to tactically time the "activeness" of their portfolio strategies as alpha-capture opportunities change.

Our results suggest that the dispersion and VIX signals will be most useful to investors pursuing absolute return strategies, however, as the signals are not useful for identifying economically significant changes in information ratio dispersion. Because active risk expands (contracts) by only slightly more than alpha following periods of high (low) dispersion or the VIX, the forecasts of information ratio dispersion are statistically significant, but the differences in IR dispersion across high- and low-volatility periods are too small to be economically significant.

MOTIVATION AND PRIOR LITERATURE

Most research into active money management concludes that the majority of managers underperform their benchmarks. The prevalence of negative alphas among mutual funds (net of expenses and trading costs) is well-documented by studies such as Elton, et al. [1993], Carhart [1997] and Bogle [1998]. More recently, Standard & Poor's Indices vs. Active Funds

(SPIVA) 2009 scorecard reports that over the period 2004-2008, 63% of large cap mutual funds, 74% of mid-cap funds and 68% of small-cap funds trailed their benchmarks. Among international mutual funds, the underperformance rates ranged between 60-90%. Davis [2001] and Ennis and Sebastian [2002] find that small-cap managers do not add alpha when returns are adjusted for risk. Malkiel [2004] argues that even predictable patterns in equity returns cannot be exploited for profit. Barras, Scalliet and Wermers [2008] use an innovative statistical method and conclude that the proportion of zero-alpha mutual funds is higher than previously thought (approximately 75% net of fees and expenses), but find that less than 1% of funds deliver alpha in a way that is consistent with manager skill. Even critics of the efficient markets theory admit to a "… strong conviction that the number of genuinely skilled managers is quite small" [Jaeger 2008, p. 54].

The performance of investment managers in the absolute return and hedge fund space is similarly disappointing. Malkiel and Saha [2005] conclude that hedge fund returns are "… lower than commonly supposed" and that hedge funds are significantly riskier than more conventional investments. Fung, Xu and Yau [2004] also report negative average alphas for hedge funds, and Pojarliev and Levich [2008] find negative mean risk-adjusted alphas among a sample of currency managers. Writing about long-short funds, O'Hara [2009] asks "If managers can't beat the market, what purpose do they serve?" Statman [2004] provides an interesting answer to O'Hara's question with his suggestion that investors may tolerate sub-par performance because they want more from investing than the utilitarian benefits of high returns, and use their relationships with money management firms to express their social class and lifestyles.[1]

Samuelson [2004] argues that broader use of inexpensive equity indexing would boost wealth overall and make equity investors better off. French [2008] attempts to quantify this loss of wealth; he estimates that pursuing active rather than passive equity strategies caused investors' average annual returns to be lower by 0.67% of the total market cap of the U.S. stock market from 1980-2006. Applying French's estimate to 2007 — when the market capitalization of the U.S. stock market approached $15 trillion — investors would have paid the active money management industry $100 billion more in fees, expenses and trading costs than they received in value-added investment returns from active equity management.

We add a new perspective to the active equity management debate by investigating the dispersion of alpha in U.S. equity markets from 1981-2008, and how the dispersion of alpha changes with market volatility. Gorman, Sapra and Weigand [2010, p. 1] discuss how a manager's ability to add value is directly tied to the dispersion of stock returns:

> Ultimately, active portfolio management requires some dispersion of returns across stocks in order to provide a reasonable opportunity set for ranking the relative expected returns of securities.

Ratner, Meric and Meric [2006] find that changes in dispersion are an effective predictor of returns during both bull and bear market cycles in most U.S. stock sectors. Pojarliev and Levich [2008] also present evidence that excess returns are higher in periods of rising volatility. Studies by Amihud and Goyenko [2009] and Duan, Hu and McLean [2009] report similar results on the firm level — stocks with higher idiosyncratic volatility offer greater alpha-capture opportunities. The connection between volatility and alpha is gradually becoming part of the conventional wisdom of investing. For example, Rosanne Pane of Standard & Poors recently cited "lower cross-sectional dispersion" as a major reason that

fixed income managers have a harder time than equity managers outperforming their benchmarks (Grene, 2008).

Given the increasing importance of the relation between return dispersion and alpha in understanding what makes active investment strategies successful, we investigate this relation in U.S. equity markets over the period 1980-2008. In the sections that follow, we show that both the cross-sectional dispersion of stock returns and the VIX provide effective forecasts of the dispersion of alpha over the next 3 and 12 months, although neither dispersion nor the VIX forecast the dispersion of the information ratio in a similar manner. We find slightly lower (higher) IR dispersion following periods of high (low) return dispersion and the VIX, with these differences being statistically, but not economically, significant.

DATA AND METHODOLOGY

Our sample consists of all stocks included in the S&P 500 index from January 1980 to October 2008.[2] Stocks are added to and deleted from the sample as Standard & Poor's changes the composition of the index over this time period. Overall, 1,201 firms have been included in the S&P 500 index from 1980-2008. Daily stock return, stock price and shares outstanding data through 2007 are obtained from the *Center for Research in Securities Prices* database (CRSP). Adjusted stock price, stock split and actual price data from January-October 2008 are obtained from *Yahoo! Finance* and appended to the CRSP data to create one continuous dataset through October 2008. A daily time series of the VIX from 1991-2008 is also obtained from *Yahoo! Finance*. Fama-French daily systematic return factors (Fama and French, 1993), the excess market return and a time series of the risk-free rate are obtained from Ken French's website (French, 2009).

Relative to each day ($t = 0$) in the 28-year sample period, a Fama-French 4-factor market model regression (FF4) is estimated for each firm i over days $t = -252$ to -1:[3]

$$R_{i,t} - r_{ft} = \alpha_{i,t}^{FF4} + \beta_{i,1}^{FF4}\left(R_{MKT_t} - r_{ft}\right) + \beta_{i,2}^{FF4}\left(R_{SMB_t}\right) + \beta_{i,3}^{FF4}\left(R_{HML_t}\right) + \beta_{i,4}^{FF4}\left(R_{UMD_t}\right) + \varepsilon_{it}. \quad (1)$$

The alpha for firm i on event day t is the excess return, computed as the daily return of firm i minus the firm's expected return based on each day's FF4 regression:

$$\hat{\alpha}_{i,t}^{FF4} = \bar{R}_{i,t} - \left[\bar{r}_{ft} + \hat{\beta}_{i,1}^{FF4}\left(\overline{R_{MKT} - r_f}\right) + \hat{\beta}_{i,2}^{FF4}\left(\bar{R}_{SMB}\right) + \hat{\beta}_{i,3}^{FF4}\left(\bar{R}_{HML}\right) + \hat{\beta}_{i,4}^{FF4}\left(\bar{R}_{UMD}\right)\right]. \quad (2)$$

The active (idiosyncratic) risk for each firm i on day t is computed as the standard deviation of the regression residuals from Equation 1. The information ratio for firm i on day t equals firm i's estimated daily alpha (Equation 2) divided by its active risk on day t:

$$IR_{i,t} = \frac{\hat{\alpha}_{i,t}^{FF4}}{\hat{\sigma}_{\varepsilon i,t}}. \quad (3)$$

We compute the volatility of the S&P 500 for each day t based on the prior 252 trading days, which measures the extent to which the index's returns have been varying around their *time series* mean over the last trading year:

$$\sigma_{Time\ Series,t} = \left[\sum_{t=-252}^{-1} \frac{\left(R_{S\&P500,t} - \bar{R}_{S\&P500}\right)^2}{t-1}\right]^{1/2}. \quad (4)$$

We also compute the dispersion of the index for each day t, which measures the extent to which the returns of all 500 stocks in the index have varied cross-sectionally around the index's mean return on day t:

$$\sigma_{Cross\ Section,t} = \left[\sum_{i=1}^{n} \frac{\left(R_{i,t} - \bar{R}_{S\&P500,t}\right)^2}{n-1}\right]^{1/2}. \quad (5)$$

Additionally, we compute the daily cross-sectional dispersion of alpha on day t:

$$\sigma_{\alpha,t} = \left[\sum_{i=1}^{n} \frac{\left(\alpha_{i,t} - \bar{\alpha}_{S\&P500,t}\right)^2}{n-1}\right]^{1/2} \tag{6}$$

and the daily cross-sectional dispersion of the information ratio on day t:[4]

$$\sigma_{IR,t} = \left[\sum_{i=1}^{n} \frac{\left(\frac{\hat{\alpha}_{i,t}}{\hat{\sigma}_{\varepsilon,t}} - \overline{IR}_{S\&P500,t}\right)^2}{n-1}\right]^{1/2}. \tag{7}$$

Gorman, Sapra and Weigand [2010] develop a theoretical framework that shows, holding managers' information coefficients constant, that active returns will be linearly related to the cross-sectional dispersion of returns. Our first hypothesis, therefore, is that higher (lower) values of the cross-sectional dispersion of returns (σ_{CS}) or the VIX will be associated with higher (lower) future dispersion of alpha. The null and alternative hypotheses for this idea can be expressed formally as:

H_0^1: α dispersion following high σ_{CS} (VIX) $\leq \alpha$ dispersion following low σ_{CS} (VIX)

H_A^1 α dispersion following high σ_{CS} (VIX) $> \alpha$ dispersion following low σ_{CS} (VIX).

Rejection of the null hypothesis under H_1 would be consistent with the idea that alpha dispersion increases following high dispersion/high VIX periods, and that higher return dispersion and volatility serve as signals for skilled managers to increase the "activeness" of their portfolio strategies, since there is a greater opportunity to earn higher alphas. Absolute return investors, concerned with earning pure alpha, would find these signals profitable. As there is no precise theory to guide us in how far into the future to test this relation, we select two time frames corresponding with shorter- and longer-term portfolio strategies: 3 and 12 months ahead (63 and 252 trading days, respectively).

Our next hypothesis also follows from the Gorman, Sapra and Weigand [2010] model, which shows that tracking error will also be linearly related to cross-sectional dispersion. Therefore, our hypotheses regarding the information ratio is that IR dispersion will remain unchanged following high- and low-levels of return dispersion or the VIX, since active returns and tracking error are expected to change proportionally with return dispersion. The null and alternative hypotheses for this idea can be expressed formally as:

$\mathbf{H_0^2}$: IR dispersion following high σ_{CS} (VIX) = IR dispersion following low σ_{CS} (VIX)

$\mathbf{H_A^2}$: IR dispersion following high σ_{CS} (VIX) ≠ IR dispersion following low σ_{CS} (VIX).

Failure to reject the null hypothesis suggests that high dispersion/high VIX periods do not signal opportunities to earn higher information ratios. Thus, relative return investors, keeping score vs. an equity index, would not find the volatility signals useful.

THE CROSS-SECTIONAL DISPERSION OF RETURNS, ALPHA AND THE IR

This section presents our empirical results. We begin with a comparison of volatility, dispersion and the VIX. In the sections that follow we show how the cross-sectional dispersion of alpha and the information ratio vary with the market volatility metrics. In the exhibits below, the measures of dispersion and volatility are depicted as smoothed moving averages (21 trailing days) to help the reader more easily discern the patterns and correlations referred to in our analysis.

Time Series and Cross-Sectional Volatility and the VIX

Exhibit 1 depicts the volatility of the S&P 500 from 1981-2008 and the VIX from 1991-2008 (the VIX becomes available as a time series in 1991).[5] The VIX is the Chicago Board Options Exchange (CBOE) implied volatility measure, computed from the implied

volatilities of a variety of S&P 500 index options. The VIX is usually interpreted as a forecast of equity market volatility over the next 30 days. The shaded vertical bars depict bear market periods in U.S. stocks, identified using the algorithm developed by Pagan and Sossounov [2003].[6] The graph is consistent with the widely-accepted idea that volatility is higher in bear markets. Exhibit 2 shows that the VIX has a contemporaneous correlation coefficient of +0.835 with the volatility of the S&P 500, and is correlated +0.676 with volatility 30 days ahead (21 trading days). This provides confirmation that, consistent with its typical interpretation, the VIX provides reasonably effective forecasts of the time series volatility of U.S. stocks.

Gorman, Sapra and Weigand [2010] show that the cross-sectional dispersion of returns is related to time series volatility. Exhibit 3 depicts the volatility and dispersion of S&P 500 daily returns (computed as shown in Equation 5). The graph shows that return volatility and dispersion tend to move together, and are generally higher in bear markets. As expected, the series have a strong contemporaneous correlation (+0.728). Exhibit 4 depicts S&P 500 dispersion and the VIX. These series also appear to move together, which is confirmed by their contemporaneous correlation coefficient of +0.758. Moreover, the VIX forecasts dispersion as accurately as it does time series volatility — the correlation coefficient between the VIX and dispersion 30 days ahead is +0.700. The VIX can therefore be interpreted as a signal of not only time-series volatility, but also cross-sectional dispersion over the next trading month.

Stock Return Volatility and the Cross-Sectional Dispersion of Alpha

Gorman, Sapra and Weigand [2010] describe how the dispersion of returns around a benchmark index influences active managers' ability to outperform the benchmark.

Specifically, greater dispersion presents active investors with better opportunities to identify high- and low-performing stocks. In this section we examine the cross-sectional dispersion of realized alpha and how it varies with the measures of volatility described in the previous section. Exhibit 5 compares the dispersion of alpha and the S&P 500's daily returns from 1981-2008. As expected, the dispersion of alpha increases and decreases with the overall dispersion of returns.

We take a more detailed look at the dispersion of alpha in Exhibit 6, which depicts the annualized median alphas for the 10th, 25th, 50th, 75th and 90th alpha percentiles from 1981-2008. The exhibit introduces several points that are key to our analysis. First, the dispersion of the alpha percentiles are related to one another — their relative spreads expand and contract together, with these spreads increasing noticeably during bear markets. Second, and most important, the percentage spreads between the alpha categories are large and economically significant (elaborated on further in Exhibits 9 and 10). The median alphas from the performance percentiles depicted in Exhibit 6 are separated by approximately 14-15% (from the 10th to 25th percentile, 25th to 50th, etc.). This means that in the presence of perfect foresight, the difference in alpha between a manager's positive view stock, which might rank in his/her 75th percentile of conviction, and a stock ranked "strong buy," which might rank in his/her 90th percentile of conviction, would average 14-15% per year. Or, to frame the results in Exhibit 6 another way, a manager who was skilled at going long stocks in the 75th performance percentile and short stocks in the 25th performance percentile should earn average portfolio alphas of 28-30% per year before fees and costs.

Exhibit 7 overlays the cross-sectional dispersion series onto a chart of the 25th, 50th and 75th median alpha percentiles, which confirms that the relative performance of high- and

low-performing stocks expands and contracts with the dispersion of stock returns. Of course, the *contemporaneous* correlation between the dispersion of returns and alpha is less interesting than establishing a correlation between changes in stock return dispersion today and *future* alpha dispersion. This is the question we address in Exhibits 8-11: Does the dispersion of stock returns provide a forecast of the future dispersion of alpha?

Exhibit 8 reports the correlation coefficients between return dispersion and the VIX and the median annualized alpha from the 10th and 90th alpha percentiles, 63 and 252 days ahead (3 and 12 trading months, respectively). The Panel A results show that as dispersion increases, the future alphas of low-performing (10th percentile) stocks become more negative, with correlations between return dispersion and median alpha of −0.43 and −0.32 over the next 63 and 252 trading days, respectively. Additionally, the future alphas of high-performing (90th percentile) stocks become more positive as cross-sectional dispersion increases, with correlations between return dispersion and alpha of +0.65 and +0.62 over the next 63 and 252 trading days. This is consistent with the idea that as return dispersion increases, alpha-capture opportunities over the next 3 months improve for both long-only and long-short managers.

Panel B shows that levels of the VIX are also related to the median alpha from the 10th and 90th alpha percentiles 63 and 252 days ahead. The correlations are similar to those observed in Panel A. This raises the interesting possibility that, rather than compute the cross-sectional dispersion of a large number of stocks themselves, active investors might be able to monitor changes in the VIX to obtain signals about the future dispersion of alpha. The following exhibits present results that suggest that this is indeed the case.

Exhibit 9 reports the median annualized alpha from the 10th, 50th and 90th alpha percentiles sorted by quintiles of the dispersion of stock returns (Panel A) and the VIX (Panel

B). The alphas in Exhibit 9 are earned over the following 63 trading days (3 calendar months). Focusing first on Panel A, we see that the median alphas in the 10th and 90th percentiles change monotonically with the quintiles of dispersion. As stock return dispersion increases, the alphas in the 10th percentile of stocks decrease across each quintile, and the alphas in the 90th percentile of stocks increase. Moreover, the differences between the median alphas in the extreme dispersion quintiles are large and economically significant: over 23% (−52% vs. −76%) across the highest to lowest 10th performance percentiles and over 33% (86% vs. 53%) across the highest to lowest 90th performance percentiles. Return dispersion therefore provides a signal of when the alphas of high- and low-performing stocks will be larger and smaller.

The differences between the 90th and 10th alpha percentiles for each quintile of return dispersion are also large. When dispersion is in its lowest quintile, the spread between the 90th and 10th stock performance percentiles over the next 63 days is 105% (+53% vs. −52%). This is the *lowest* median quintile spread of equity alpha. When return dispersion is in its highest quintile, the 90th to 10th percentile median annualized alpha spread over the next 63 trading days is greater than 160% (+86% vs. −76%). Moreover, this difference in the high-to-low spread is statistically significant at the 1% level, based on a nonparametric Mann-Whitney statistic ($Z = 43.4$). This allows us to reject H_1 based on a 63-day window, and conclude that return dispersion provides a signal of when the alpha spread between high- and low-performing stock portfolios expands and contracts.

Panel B of Exhibit 9 shows the 10th, 50th and 90th alpha percentiles by quintiles of the VIX, once again forecasting alpha dispersion 63 days ahead. The time-series oriented VIX provides forecasts that are at least as effective as those based on cross-sectional dispersion. Not only are the median alphas in the 10th and 90th performance percentiles once again

monotonically decreasing and increasing, respectively (with the exception of the 4th to 5th quintile in the 90th percentile), but the extreme positive performance categories are accurately identified when the VIX is in its top *two* quintiles. When the VIX has ranged from 20.07% to 70.33%, which accounts for 40% of the stock market trading days from 1991-2008, the median annualized alpha of the 10th percentile over the next 3 trading months is approximately −73%, and the median annualized alpha of the 90th performance percentile is approximately +81%, a spread of 154%.

Moreover, the extreme negative performance categories are identified when the VIX is in its *bottom* two quintiles. When the VIX ranges between 9.31% and 16.33%, which accounts for another 40% of the trading days from 1991-2008, the median alphas in the 10th and 90th percentiles are approximately −55% and +55%, respectively — a spread of 110%. Both return dispersion (Panel A) and the VIX (Panel B) therefore provide effective (and in the case of the VIX, costless) market signals of whether the next 3 trading months represent better or worse opportunities for alpha hunters, identifying average differences in alpha-capture opportunities across high- and low-performing stocks of 54% and 44% (respectively). As was the case in Panel A, the alpha spread between the high and low VIX quintiles is statistically significant at the 1% level ($Z = 33.7$), indicating rejection of H_1 (no difference between the median alphas in the high and low VIX quintiles) based on the VIX and a 63-day window. Both return dispersion and the VIX can therefore serve as indicators of when equity investors should increase or decrease the "activeness" of their long-only and long-short strategies.

Exhibit 10 repeats the analysis from Exhibit 9, reporting median alphas over the following 252 days (1 trading year) by quintiles of return dispersion (Panel A) and the VIX (Panel B). Although the magnitude of the median alpha levels is smaller, indicating a less

informative forecast overall, the spreads between the high- and low-performing percentiles are still large and economically significant. For example, when dispersion is in its lowest quintile, the median alpha spread between the 10th and 90th percentiles over the next 252 trading days is 53%, whereas the spread in the highest quintile of dispersion is 74%. This difference is once again significant at the 1% level ($Z = 35.9$), which allows us to reject H$_1$ using a 252-day window. As was the case in Exhibit 9, the signals based on the VIX are just as effective as those based on cross-sectional dispersion, and also statistically significant ($Z = 33.9$). The alpha spreads over the 252-day horizon are smaller than those over the 63-day horizon, however, indicating that dispersion and the VIX provide more effective signals of alpha dispersion over 3 month, rather than 1 year time frames.

Stock Volatility and the Cross-Sectional Dispersion of the Information Ratio

We next investigate whether the cross-sectional dispersion of returns and the time-series focused VIX forecast the future dispersion of the information ratio. Exhibit 11 depicts the dispersion of returns and the information ratio. Visually, the two series do not appear to vary together in any obvious manner. Panel A of Exhibit 12 reports the correlation between dispersion and the 10th and 90th information ratio percentiles 63 and 252 days ahead. The 10th percentile of the information ratio increases with dispersion, with correlations of +0.33 63 days ahead and +0.41 252 days ahead. Dispersion has no relation with the 90th information ratio percentile 63 days ahead, and only a weak positive relation 252 days ahead (correlation = +0.27). Cross-sectional return dispersion does not forecast dispersion of the information ratio in the same way it forecasted alpha dispersion, but instead suggests a slight *inverse* relation, as the 10th information ratio percentile increases with dispersion. Panel B of Exhibit

12 shows that the same is true of the VIX. The correlations are similar to those for cross-sectional dispersion.

Exhibit 13 presents the median information ratio 63 days ahead sorted by quintiles of cross-sectional dispersion (Panel A) and the VIX (Panel B). As the quintiles of return dispersion increase, there is a slight increase in the 10th percentile median (−2.61 to −2.19), and a slight decrease in the 90th percentile median (+2.69 to +2.66). The 90th minus 10th percentile spread in both Panels A and B narrows from 5.3 to 4.9 as dispersion and the VIX increase, and although this change is small, it is statistically significant at the 1% level based on a two-tailed test ($Z = -15.5$ based on return dispersion and −9.1 based on the VIX). We therefore reject H_2 based on a 63-day window, finding instead that dispersion of the information ratio *contracts* slightly as return dispersion and the VIX increase.

Exhibit 14 presents the 252-day forecasts of the median information ratio, once again sorted by quintiles of return dispersion (Panel A) and the VIX (Panel B). The results are similar to those in Exhibit 13. In Panel A, the 90th minus 10th information ratio spread narrows from 2.4 to 2.2 from the low- to high-return dispersion quintile, and from 2.3 to 2.2 from the low- to high-VIX quintile. Both of these changes are statistically significant at the 1% and 2% levels, respectively ($Z = -20.5$ and −2.4). We therefore also reject H_2 based on a 252-day window. As return dispersion and the VIX increase they provide forecasts of a narrowing of information ratio dispersion that is statistically significant, but in all likelihood not economically significant (especially considering the costs of chasing these small changes). This occurs because the dispersion of tracking error expands and contracts more than the dispersion of alpha at different levels of return dispersion and the VIX (results not presented but available upon request). Overall, our findings indicate that return dispersion and the VIX

generate signals that will be useful to absolute return investors keeping score in an alpha-based framework, but not for relative return investors who measure portfolio performance using the information ratio.

Implications for Alpha-Focused Strategies and Manager Performance

The findings presented above provide the opportunity to comment on several additional perspectives regarding alpha generation and the measurement of manager performance. First, the results presented in Exhibits 6, 9 and 10 suggest that active equity managers are not underperforming their indexes due to inadequate dispersion or supply of alpha. In the presence of manager skill, the alphas that can be earned in higher-performing stocks are large and economically significant. Our analysis shows that even in the 75th performance percentile, annualized alpha has averaged 15.2% since 1981, ranging from a low of 7.8% to a high of 44.0%. This means that for the past 27 years fully one-fourth of all S&P 500 stocks have outperformed the Fama-French 4-factor model by an average of 15.2% per year, and never less than 7.8% in any year.

Our results also suggest that alpha-hunters might also be owed a bit of sympathy, however. Although dispersion and the VIX provide signals of future alpha dispersion, and the alpha spread differences in low- vs. high-volatility periods are quite large — 44% to 54% for the VIX and return dispersion, respectively — dispersion, the VIX and alpha dispersion are significantly higher in bear markets, which means that alpha-generation opportunities are best during periods when equity values are generally declining and volatility is high. From 1981-2008, dispersion averages 38.9% during bear markets, and the spread between the median alphas from the 90th and 10th performance percentiles averages 74.2%. During bull markets, however, dispersion averages 29.7% and the spread between the median alphas from the 90th

and 10th performance percentiles shrinks to an average of 57.9%. The best time for skilled managers to increase the activeness of their portfolios is during periods of declining stock prices and high volatility — exactly when investors desire to decrease equity allocations and reduce their overall risk exposure.

CONCLUSIONS

We find that the cross-sectional dispersion of U.S. equity returns and the VIX provide forecasts of the dispersion of alpha over both 3-month and 1-year horizons. As dispersion and the VIX increase and decrease, they provide signals of when the alphas of high- and low-performing stocks will be larger and smaller, and when the alpha *spreads* between high- and low-performing stock portfolios are expected to expand and contract. Return dispersion and the VIX can therefore be thought of as indicators of when equity investors should increase or decrease the "activeness" of their long-only and long-short strategies. Investors can calculate return dispersion or observe the VIX and infer a forecast of the overall dispersion of equity alpha over the next 3 to 12 months, and use this information to tactically time the "activeness" of their portfolio strategies as alpha-capture opportunities change.

Our findings suggest that the dispersion and volatility signals will be most useful to investors pursuing absolute return strategies, however, as they provide signals regarding changes in the dispersion of the information ratio that are statistically, but not economically, significant. Because active risk expands (contracts) by only slightly more than alpha following periods of high (low) dispersion or the VIX, the forecasts of information ratio dispersion are statistically significant, but the differences in IR dispersion across high- and low-volatility periods are too small to be economically significant.

One of the main difficulties facing active investors in using the alpha signals arises because return dispersion, the VIX and alpha dispersion increase during bear markets, which means that alpha-capture opportunities are best during periods when equity values are generally declining and volatility is high. The best opportunities for skilled investors to increase portfolio activeness and hunt alpha present themselves when most investors are decreasing equity allocations and trying to reduce the risk exposure of their portfolios.

Endnotes

1. It seems reasonable to conclude that Bernie Madoff was skilled at exploiting investors' need for expressive benefits.

2. An anonymous reviewer points out that the final period covered in our study, October 2007 to October 2008, was associated with unusually high volatility. We explicitly bring this point to the reader's attention, but ultimately thought it was best to retain this period in the analysis.

3. Re-estimating the models that follow using a one-factor Capital Asset Pricing Model did not materially change any of our findings or conclusions. These results are available upon request.

4. Because the estimate of alpha and idiosyncratic volatility (a.k.a. tracking error) are not uncorrelated, the well known relation $\text{cov}(x, y) = E[xy] - E[x] - E[y]$ implies that the proper way to measure the cross-sectional volatility of the information ratio is by computing the cross-sectional volatility of $\dfrac{\hat{\alpha}}{\hat{\sigma}_\varepsilon}$, rather than the cross-sectional volatility of $\hat{\alpha}$ divided by the cross-sectional volatility of $\hat{\sigma}_\varepsilon$.

5. In Exhibits 2 and 8 the reported correlation coefficients between the VIX and the other volatility measures use daily data from 1991-2008. The correlations between the time series and cross-sectional volatility measures use daily data from 1981-2008.

6. While the general rule that a 20% decline from a market high marks the beginning of a bear market in stocks, there is no widely-accepted rule for identifying the end of a bear market. We therefore use the Pagan and Soussonov [2003] algorithm for dating the beginning and end of bear market periods.

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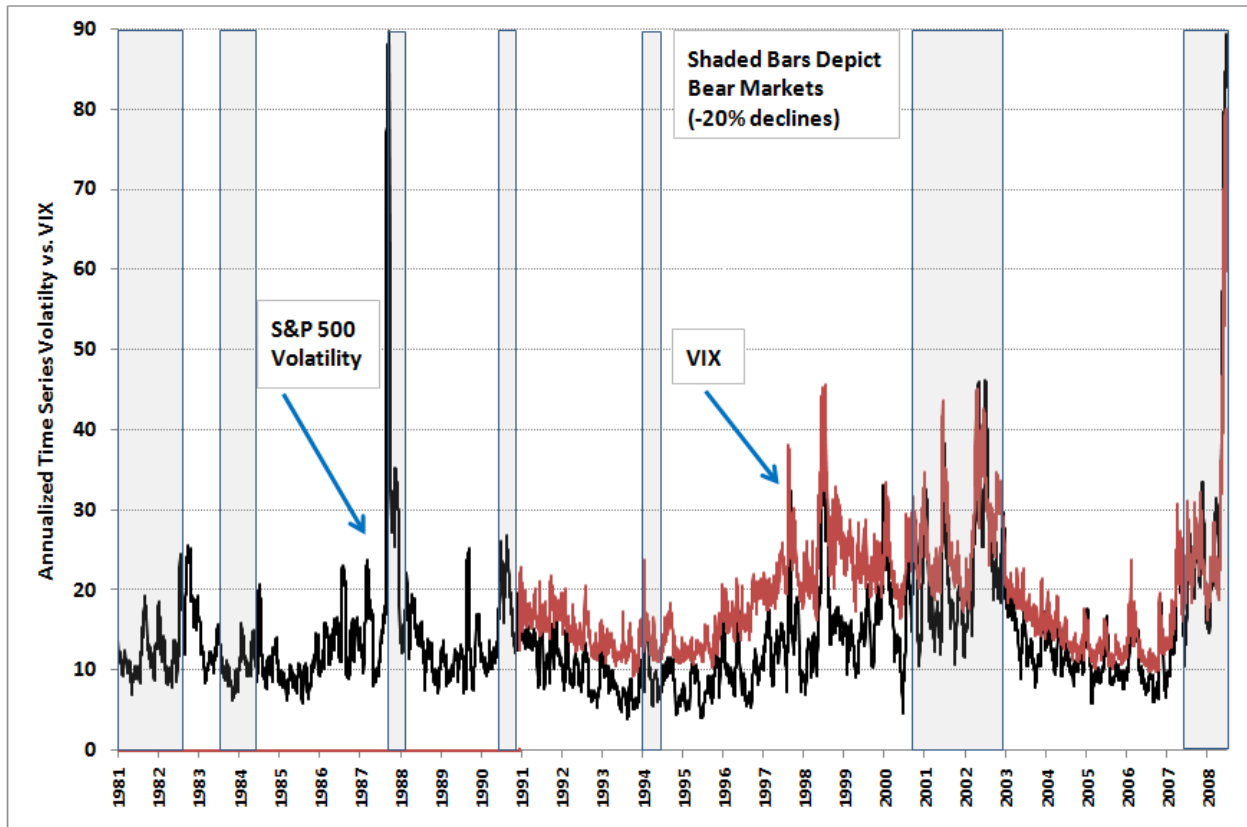
Exhibit 1: Time Series Volatility of the S&P 500 vs. the VIX, 1981-2008, with 21-day Smoothing.

Exhibit 2: Correlations Between Volatility Measures

Panel A: Contemporaneous Correlations

	VIX	Time Series	Cross-Sectional
VIX	1.000		
Time Series	0.835	1.000	
Cross-Sectional	0.758	0.728	1.000

Panel B: Forward-Looking (30-Day Ahead) Correlations

|	VIX	Time Series	Cross-Sectional
VIX$_{30}$	0.790		
Time Series$_{30}$	0.676	0.556	
Cross-Sectional$_{30}$	0.700	0.476	0.823

* Correlation coefficients vs. the VIX are calculated using daily data from 1991-2008, all others are calculated using daily data from 1981-2008.
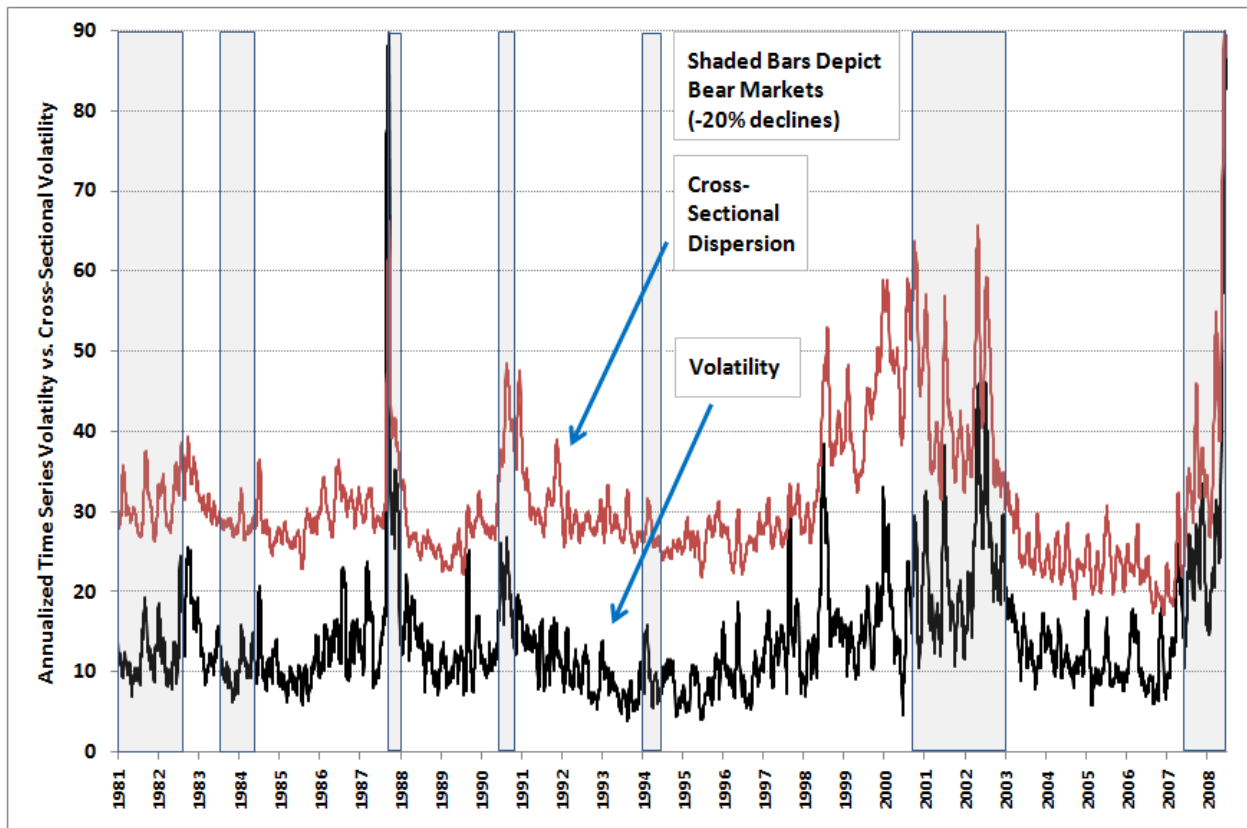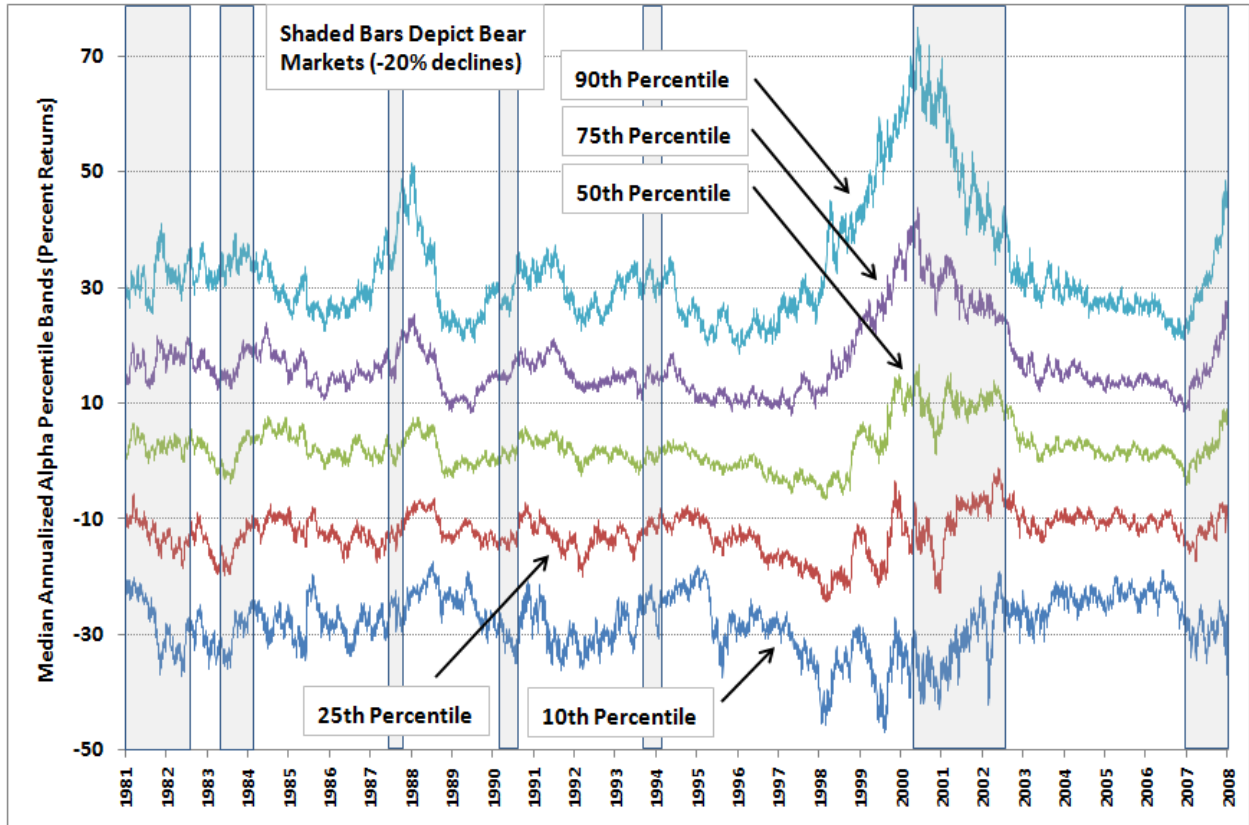
Exhibit 3: Cross-Sectional Dispersion vs. Time Series Volatility of the S&P 500, 1981-2008, with 21-day Smoothing.
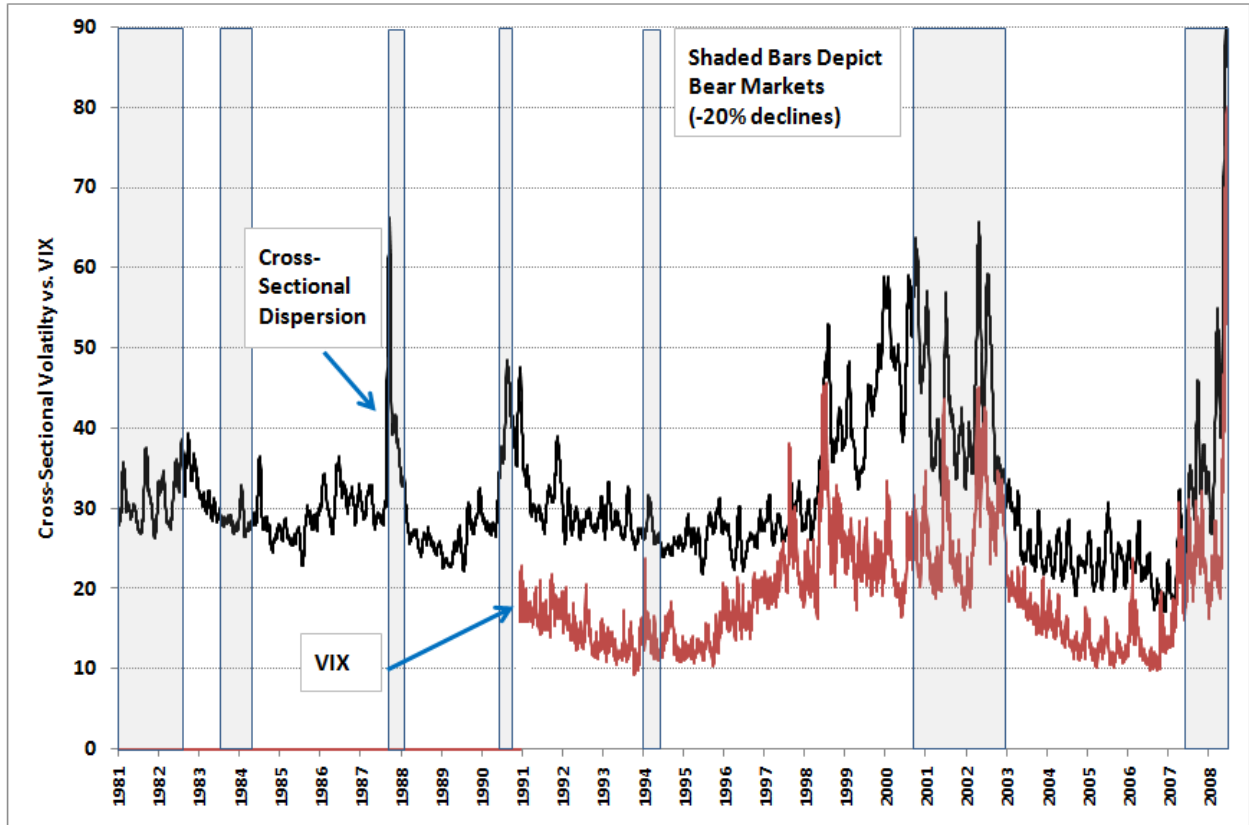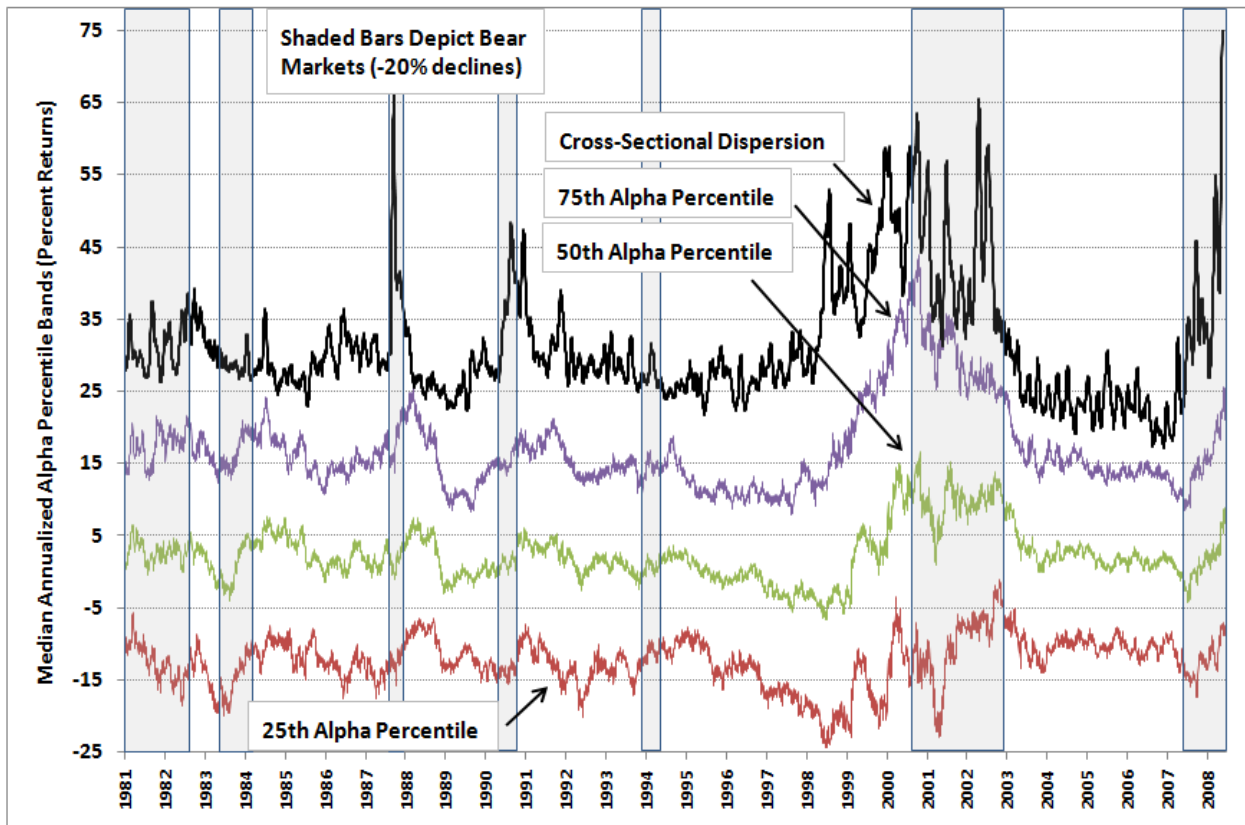
Exhibit 4: Cross-Sectional Dispersion of the S&P 500 vs. the VIX, 1981-2008, with 21-day Smoothing.
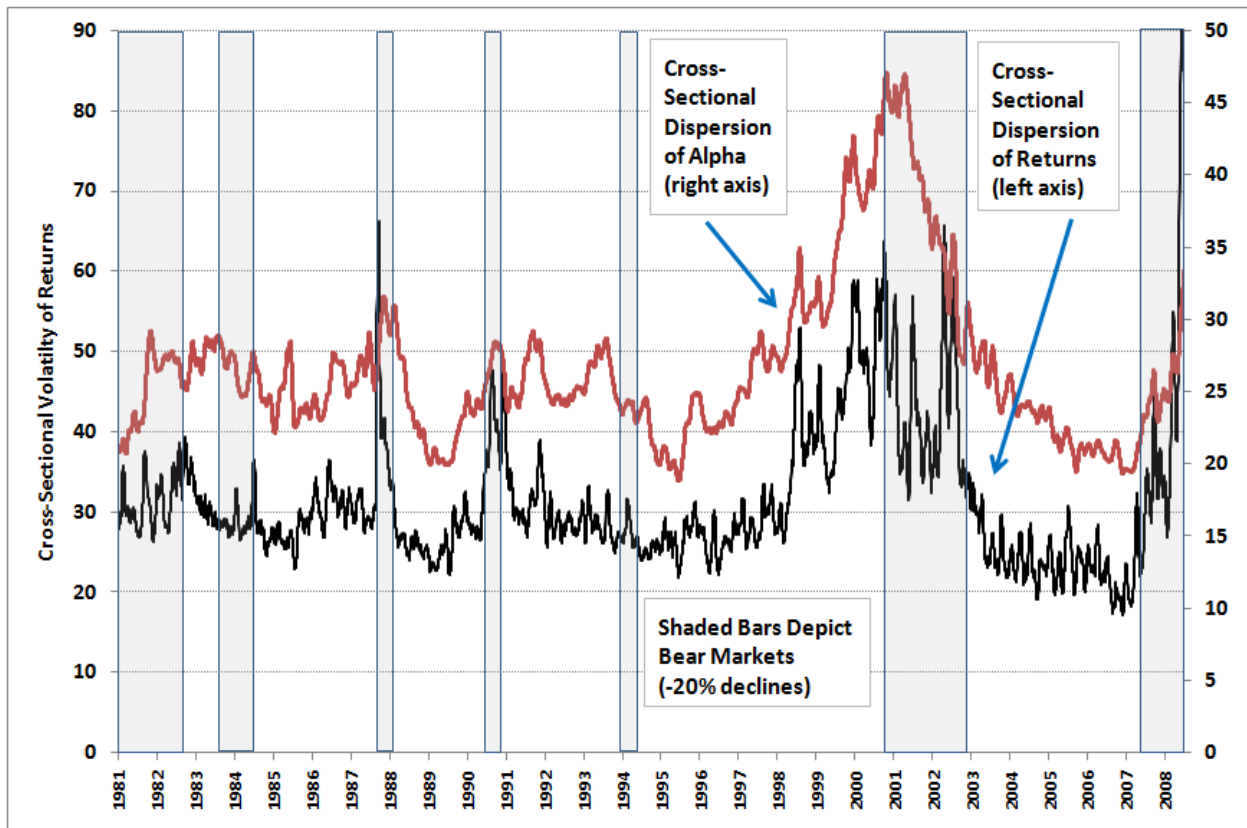
Exhibit 5: Cross-Sectional Volatility of Stock Returns and Alpha, 1981-2008, with 21-day Smoothing.

Exhibit 6: Annualized Alpha Percentile Bands, 1981-2008.

Exhibit 7: Annualized Alpha Percentile Bands and Cross-Sectional Dispersion, 1981-2008.

Exhibit 8: Correlations Between Dispersion, the VIX and Future Alpha

Panel A: Cross-Sectional Dispersion and Alpha

Looking Ahead	10th Alpha Percentile	90th Alpha Percentile
63 Days	−0.43	+0.65
252 Days	−0.32	+0.62

Panel B: The VIX and Alpha

Looking Ahead	10th Alpha Percentile	90th Alpha Percentile
63 Days	−0.43	+0.53
252 Days	−0.44	+0.52

* Correlation coefficients vs. the VIX are calculated using daily data from
1991-2008, all others are calculated using daily data from 1981-2008.

Exhibit 9: Cross-Sectional Dispersion, The VIX and Alpha: 63 Day Forecasts

Panel A: Cross-Sectional Dispersion and Alpha 63 Days Ahead (3 Trading Months)

	Cross-Sectional Dispersion of Returns			Alpha 10th Percentile			Alpha 50th Percentile			Alpha 90th Percentile		
Quintile	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**23.52**	17.16	25.73	**-52.33**	-105.38	-34.36	**1.31**	-14.35	11.47	**52.59**	39.52	76.06
2	**27.07**	25.74	28.03	**-59.96**	-134.47	-36.54	**0.54**	-15.46	22.67	**60.00**	36.53	137.30
3	**29.08**	28.03	30.43	**-63.20**	-145.32	-37.04	**1.78**	-16.75	27.32	**64.55**	44.04	153.72
4	**32.55**	30.43	35.76	**-64.85**	-128.05	-39.45	**2.05**	-15.65	28.26	**66.54**	46.47	122.23
5	**42.96**	35.76	90.66	**-75.65**	-139.02	-39.30	**8.09**	-13.02	29.88	**86.05**	46.99	136.78

Panel B: The VIX and Alpha 63 Days Ahead (3 Trading Months)

	VIX			Alpha 10th Percentile			Alpha 50th Percentile			Alpha 90th Percentile		
Quintile	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**11.97**	9.31	13.16	**-54.02**	-99.59	-34.36	**1.40**	-14.35	9.62	**54.49**	40.56	81.65
2	**14.73**	13.17	16.33	**-56.47**	-134.87	-36.54	**1.87**	-12.74	22.17	**55.95**	41.15	115.08
3	**18.15**	16.33	20.07	**-64.17**	-145.32	-39.03	**1.56**	-15.46	29.88	**61.96**	42.03	134.65
4	**21.98**	20.07	24.31	**-73.20**	-132.48	-41.38	**4.60**	-16.75	28.12	**81.61**	45.29	133.54
5	**28.18**	24.32	70.33	**-74.02**	-139.02	-44.94	**6.48**	-13.91	29.62	**81.40**	47.79	136.78

* Results vs. the VIX are calculated using daily data from 1991-2008, all other results are calculated using daily data from 1981-2008.

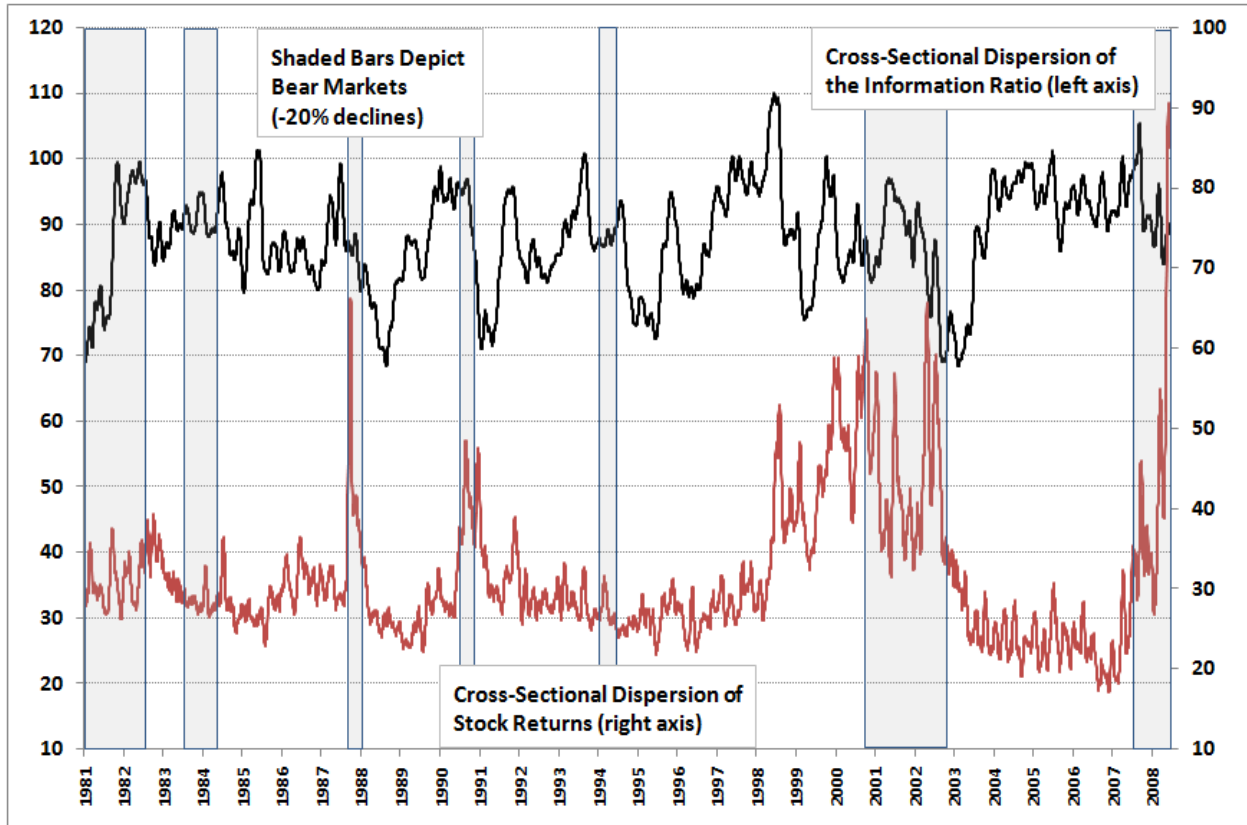**Exhibit 10: Cross-Sectional Dispersion, The VIX and Alpha: 252 Day Forecasts**

Panel A: Cross-Sectional Dispersion and Alpha 252 Days Ahead (12 Trading Months)

Quintile	Cross-Sectional Dispersion of Returns			Alpha 10th Percentile			Alpha 50th Percentile			Alpha 90th Percentile		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**23.52**	17.16	25.73	**-26.28**	-40.55	-18.76	**0.91**	-5.73	8.99	**26.73**	19.65	48.53
2	**27.07**	25.74	28.03	**-27.11**	-45.60	-18.05	**0.59**	-6.69	9.04	**27.26**	18.40	46.96
3	**29.08**	28.03	30.43	**-27.97**	-45.58	-17.69	**1.97**	-6.50	10.13	**30.93**	20.29	51.55
4	**32.55**	30.43	35.76	**-27.61**	-38.39	-17.19	**2.21**	-5.89	14.74	**32.97**	20.85	65.12
5	**42.96**	35.76	90.66	**-31.24**	-46.96	-19.45	**5.43**	-4.07	16.65	**43.23**	22.44	75.79

Panel B: The VIX and Alpha 252 Days Ahead (12 Trading Months)

Quintile	VIX			Alpha 10th Percentile			Alpha 50th Percentile			Alpha 90th Percentile		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**11.97**	9.31	13.16	**-24.61**	-37.57	-18.09	**0.67**	-4.24	3.63	**26.13**	18.40	35.17
2	**14.73**	13.17	16.33	**-25.98**	-35.50	-18.05	**0.84**	-5.73	7.78	**26.95**	19.84	45.92
3	**18.15**	16.33	20.07	**-29.08**	-45.13	-20.53	**1.79**	-5.87	14.98	**28.75**	20.66	69.10
4	**21.98**	20.07	24.31	**-31.67**	-45.60	-19.02	**4.52**	-6.69	15.61	**40.03**	22.14	75.79
5	**28.18**	24.32	70.33	**-31.60**	-46.96	-20.24	**4.29**	-6.62	16.65	**41.03**	26.40	72.32

* Results vs. the VIX are calculated using daily data from 1991-2008, all other results are calculated using daily data from 1981-2008.

Exhibit 11: Cross-Sectional Dispersion of Returns and the Information Ratio, 1981-2008.

Exhibit 12: Correlations Between Volatility Measures and the Information Ratio

Panel A: Cross-Sectional Volatility and the Information Ratio

Looking Ahead	10th IR Percentile	90th IR Percentile
63 Days	+0.33	0.00
252 Days	+0.41	+0.23

Panel B: The VIX and the Information Ratio

Looking Ahead	10th IR Percentile	90th IR Percentile
63 Days	+0.24	+0.02
252 Days	+0.31	+0.27

* Correlation coefficients vs. the VIX are calculated using daily data from 1991-2008, all others are calculated using daily data from 1981-2008.

Exhibit 13: Cross-Sectional Dispersion, The VIX and the Information Ratio: 63 Day Forecasts

Panel A: Cross-Sectional Dispersion and the Information Ratio 63 Days Ahead (3 Trading Months)

Quintile	Cross-Sectional Dispersion of Returns			Information Ratio 10th Percentile			Information Ratio 50th Percentile			Information Ratio 90th Percentile		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	23.52	17.16	25.73	-2.61	-4.39	-1.69	0.07	-0.85	0.64	2.69	1.82	3.50
2	27.07	25.74	28.03	-2.66	-4.39	-1.63	0.03	-0.65	1.10	2.66	1.73	4.56
3	29.08	28.03	30.43	-2.54	-4.35	-1.34	0.08	-0.67	1.07	2.69	1.84	4.52
4	32.55	30.43	35.76	-2.50	-4.04	-1.26	0.09	-0.65	1.18	2.58	1.73	4.75
5	42.96	35.76	90.66	-2.19	-4.23	-1.26	0.28	-0.44	1.14	2.66	1.79	4.65

Panel B: The VIX and the Information Ratio 63 Days Ahead (3 Trading Months)

Quintile	VIX			Information Ratio 10th Percentile			Information Ratio 50th Percentile			Information Ratio 90th Percentile		
	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	11.97	9.31	13.16	-2.57	-4.39	-1.70	0.07	-0.85	0.48	2.68	1.94	3.32
2	14.73	13.17	16.33	-2.50	-4.24	-1.76	0.10	-0.75	0.85	2.68	1.93	4.42
3	18.15	16.33	20.07	-2.65	-4.39	-1.60	0.08	-0.67	1.18	2.71	1.92	4.56
4	21.98	20.07	24.31	-2.42	-4.04	-1.59	0.18	-0.66	1.09	2.78	1.90	4.75
5	28.18	24.32	70.33	-2.28	-3.85	-1.44	0.23	-0.57	1.14	2.64	1.89	4.65

* Results vs. the VIX are calculated using daily data from 1991-2008, all other results are calculated using daily data from 1981-2008.

Exhibit 14: Cross-Sectional Dispersion, The VIX and the Information Ratio: 252 Day Forecasts

Panel A: Cross-Sectional Dispersion and the Information Ratio 252 Days Ahead (3 Trading Months)

	Cross-Sectional Dispersion of Returns			Information Ratio 10th Percentile			Information Ratio 50th Percentile			Information Ratio 90th Percentile		
Quintile	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**23.52**	17.16	25.73	**-1.13**	-1.52	-0.79	**0.05**	-0.27	0.36	**1.25**	0.89	1.68
2	**27.07**	25.74	28.03	**-1.07**	-1.75	-0.65	**0.03**	-0.26	0.31	**1.13**	0.85	1.57
3	**29.08**	28.03	30.43	**-1.04**	-1.74	-0.63	**0.08**	-0.27	0.33	**1.18**	0.86	1.61
4	**32.55**	30.43	35.76	**-1.01**	-1.41	-0.49	**0.10**	-0.20	0.42	**1.19**	0.91	1.63
5	**42.96**	35.76	90.66	**-0.91**	-1.33	-0.47	**0.18**	-0.15	0.47	**1.31**	0.90	1.66

Panel B: The VIX and the Information Ratio 252 Days Ahead (3 Trading Months)

	VIX			Information Ratio 10th Percentile			Information Ratio 50th Percentile			Information Ratio 90th Percentile		
Quintile	Median	Min	Max	Median	Min	Max	Median	Min	Max	Median	Min	Max
1	**11.97**	9.31	13.16	**-1.07**	-1.46	-0.79	**0.03**	-0.23	0.18	**1.21**	0.88	1.50
2	**14.73**	13.17	16.33	**-1.10**	-1.58	-0.73	**0.04**	-0.27	0.30	**1.20**	0.85	1.53
3	**18.15**	16.33	20.07	**-1.06**	-1.75	-0.60	**0.08**	-0.25	0.42	**1.15**	0.87	1.63
4	**21.98**	20.07	24.31	**-0.89**	-1.70	-0.47	**0.15**	-0.27	0.45	**1.28**	0.93	1.67
5	**28.18**	24.32	70.33	**-0.92**	-1.72	-0.50	**0.16**	-0.26	0.47	**1.31**	0.98	1.68

* Results vs. the VIX are calculated using daily data from 1991-2008, all other results are calculated using daily data from 1981-2008.