Signs of Equity Market Strain

Intech Equity Market Stress Monitor®

Key Ideas

- We introduce a new risk profile of the equity market – a collection of five reliable indicators of market strain – to help identify different risk regimes and associated tail-risk.
- Conventional risk metrics such as standard deviation, VIX and GARCH tend to be focused on the past or, at best, current levels of volatility; the potential impact of tail-risk events is often overlooked.
- Risk metrics that comprise the Intech Equity Market Stress Monitor address different aspects of the equity markets. They are based on decades of market data and are expressed in a percentile range relevant to a specified equity index.
- Using this monitor, investors can gain additional insight to risk regimes and focus on achieving their investment objectives with greater confidence, and better oversight of their risk budget.

UNCORRELATED ANSWERS®

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Intech®

Investors may attempt market timing based on expectations, which requires them to take a positive or negative view on near-term market performance. This is a directional forecast of returns, which is extremely difficult to get consistently right. Instead, we prefer to consider the risk profile of equity markets and identify different risk regimes and their associated tail-risks. Unlike directional changes, a higher likelihood of tail events is generally announced via departures from the underlying market stability.

In this paper, we introduce a collection of equity-risk metrics that are reliable indicators of strain in the market:

- Capital Concentration
- Correlation of Returns
- Dispersion of Returns
- Index Efficiency
- Skewness of Returns

Consistent with our descriptive approach to understanding markets, these metrics avoid financial and economic assumptions, including that investors are perfectly rational and efficient at all times or, conversely, that they exhibit universal and constant behavioral anomalies.

Identifying signs of strain

These five equity-risk metrics allow investors to monitor stability across equity markets over time. For each of these metrics, even when markets deviate substantially from the typical value, they eventually return to it. Moreover, the greater the deviation, and the longer it persists, the more likely it is that the return to the mean will be abrupt, and accompanied by substantial volatility – which can sometimes lead to positive returns but is mostly associated with negative outcomes for equity markets.

Signs of strain do not always precede market crises. Intervention by central banks, investors' self-control, or even happy coincidences may either defuse the risk in the first place, or result in a soft landing. Still, it is always advisable to pay attention to signs of strain, especially when they seem to contradict market consensus.

Conventional Risk Metrics

The Global Financial Crisis of 2007–2008 taught an expensive lesson about the cost of market shocks and liquidity crunches. Over the past decade, various risk tools have become mainstream for institutional investors, who have developed their expertise in evaluating and managing risk. Risk management is now central to most investors' thinking from the asset allocation decision down to the individual holdings. However, popular risk metrics tend to be focused on the past or current levels of volatility; the potential impact of tail-risk events is often overlooked.

Standard Deviation

The most conventional measure of risk is the historical volatility, usually expressed through the standard deviation of returns over a rolling period. This is a strictly backward-looking metric, so it can't predict or respond quickly to dramatic changes. Also, even for slower shifts, it's difficult to compute it in a way that is both current and accurate: if you concentrate more on recent returns, you end up with fewer observations and weaker statistics.

VIX®

A popular alternative to the historical volatility is the VIX, which effectively averages the implied volatility of put and call options for the 500® Index. Since options are inherently forward-looking, this may seem like a reasonable approach however, the nominal time horizon is just one month ahead. More importantly, it is a consensus-based measure, which means it's a lagging or, at best, a coincident indicator of what the broad market thinks; this makes it an ill-suited tool for detecting bubbles of unjustified consensus.

GARCH

A more sophisticated approach is the family of Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) methodologies, which try to model not just the returns, but also the evolution of the underlying volatility that characterizes them. Unfortunately, they may suffer from two main problems:

- Even though they are a reasonable starting point for understanding aftershocks after an initial market dislocation, they do not help to determine when a major shock will be more likely to occur.

- They are not well-suited for identifying or modeling regime changes, because the underlying model is challenged during the transition period between any two risk regimes.

In short, conventional approaches have more value in establishing the rate at which prices fluctuate at the present or during the recent past, rather than when a major market shock is likely to occur. The following pages introduce five metrics we believe are better suited to identifying signs of market stress.

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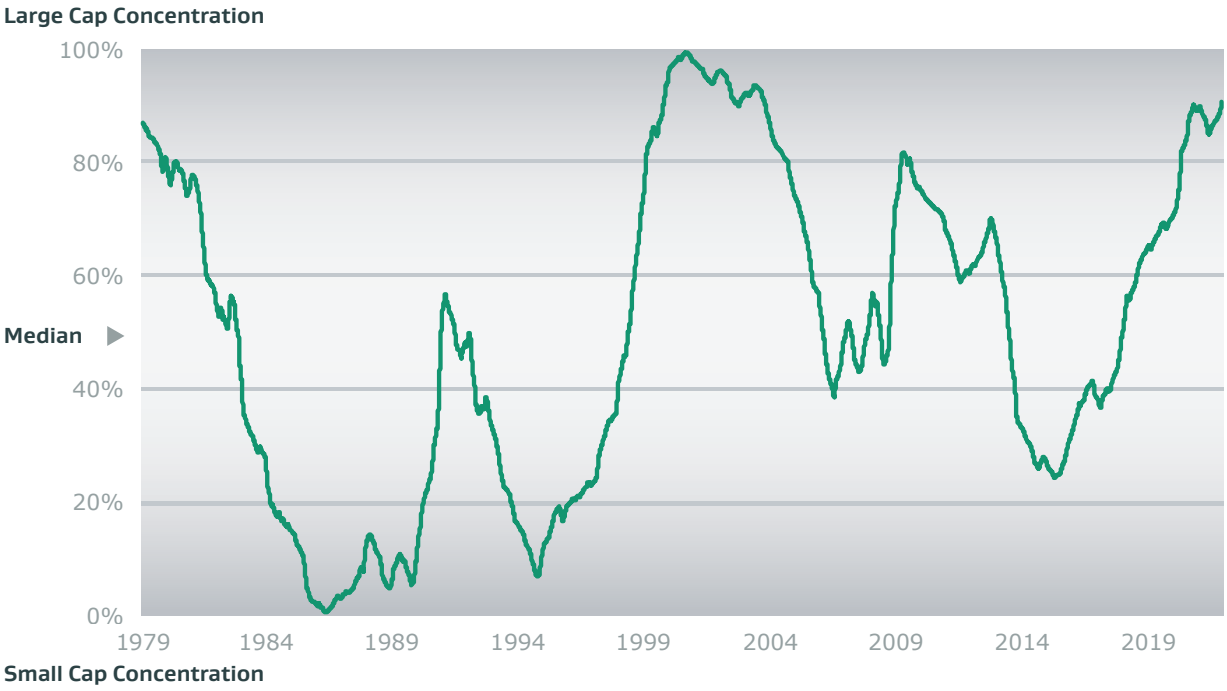
Capital Concentration
Do winners take all?

Capital concentration measures how capital is distributed among stocks within an index. An increase in this metric means that more capital is allocated to larger cap stocks. A decrease indicates that capital is moving to smaller cap stocks. Our research has shown that the capital distribution among stocks is remarkably stable over the long term and tends to revert to median levels.

For example, the top 50 stocks in the S&P 500® Index typically represent about 50% of the market capitalization. In Figure 1, we find that the market tends to be highly concentrated during a bubble (such as in the late 1990's), or when a market crisis causes investors to rush towards larger names (such as early 2009). Yet, periods of unusually low concentration also signal potential strain in the market (beginning of 1987) because this indicates excessive groupthink among smaller-capitalization stocks.

FIGURE 1
CAPITAL CONCENTRATION OF THE S&P 500® INDEX
Percentile ranks for the period ended December 31, 2021



Correlation of Returns

How similar are stocks' absolute returns?

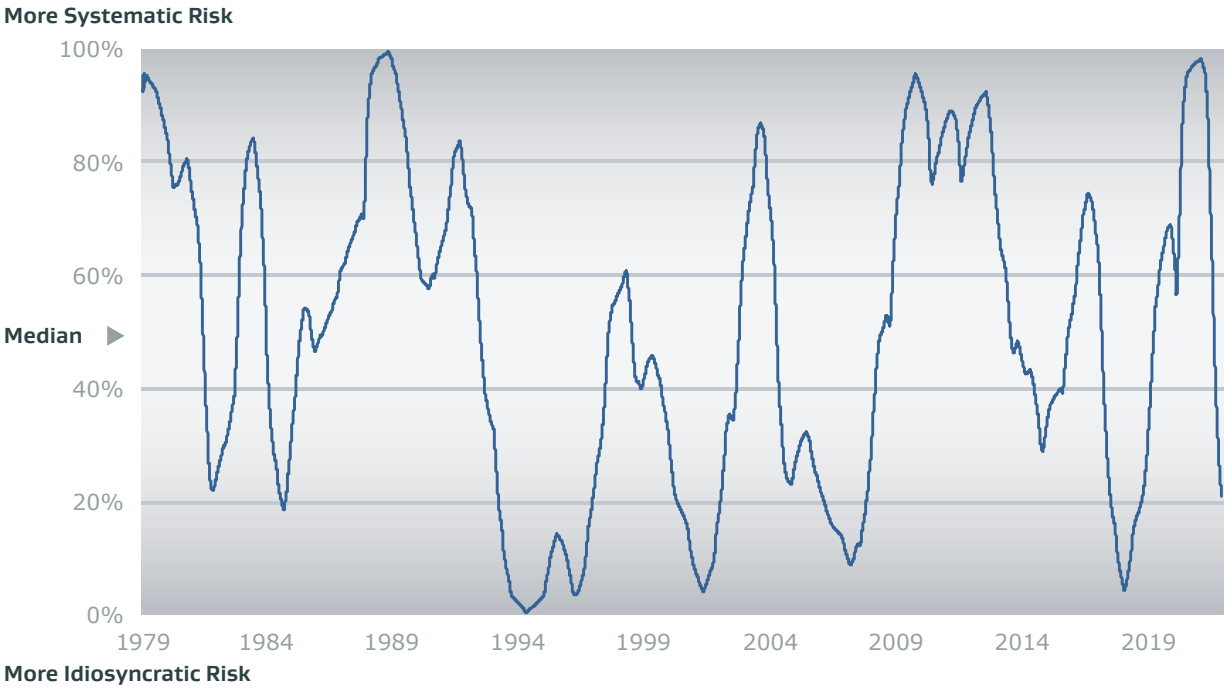
Correlation of returns measures the market-weighted average pair-wise correlation of stocks in an index. As correlations rise, the underlying stocks' returns tend to move in tandem with each other as the common component of return – the market – begins to dominate. As correlations decline, there is less commonality between stocks because a larger ingredient to their returns may be explained by idiosyncratic components rather than the market.

Used in conjunction with dispersion, it is particularly useful in confirming excessive groupthink when it tends to be extremely high (late 1980s and late 2000s) or low (mid 1990s and the beginning of 2007) relative to its median (see Figure 2). A fact which may be surprising to many investors is that dispersion and correlation tend to be higher or lower at the same time, rather than move in opposite directions.

FIGURE 2

CORRELATION OF RETURNS FOR THE S&P 500® INDEX

Percentile ranks for the period ended December 31, 2021



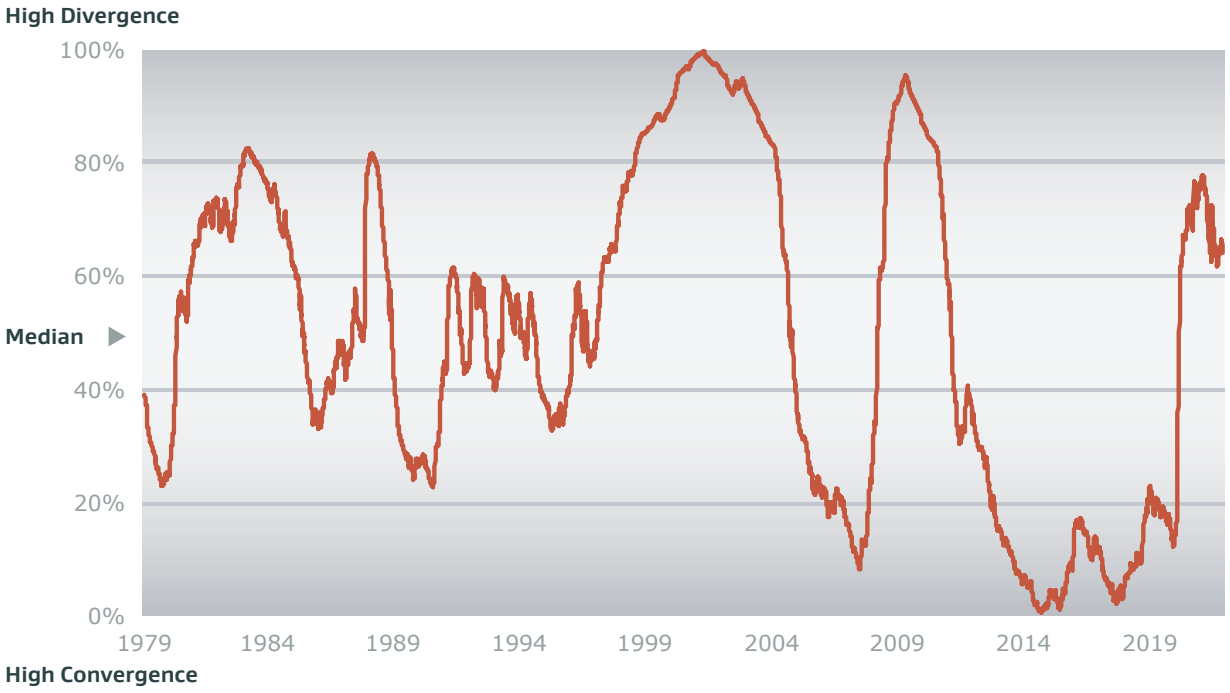
Dispersion of Returns

How different are stocks' relative returns?

Also known as cross-sectional volatility, dispersion measures whether stocks' returns relative to their benchmark are converging (low dispersion) or diverging (high dispersion). As dispersion increases, underlying stock or portfolio returns begin to diverge from the overall benchmark. We find that the market will eventually revert back to the long-term levels when return dispersion is substantially low or high, which is associated with strain on the market.

Abnormally high dispersion tends to be both a leading and a lagging indicator of a market shock (e.g., during the build-up and aftermath of the tech bubble). Abnormally low dispersion (e.g., 2005 through 2007) tends to be indicative of excessive groupthink, so it is usually an indicator of potential market strain (see Figure 3).

FIGURE 3
DISPERSION OF RETURNS FOR THE S&P 500® INDEX
Percentile ranks for the period ended December 31, 2021



Index Efficiency
How much beta risk should you take?

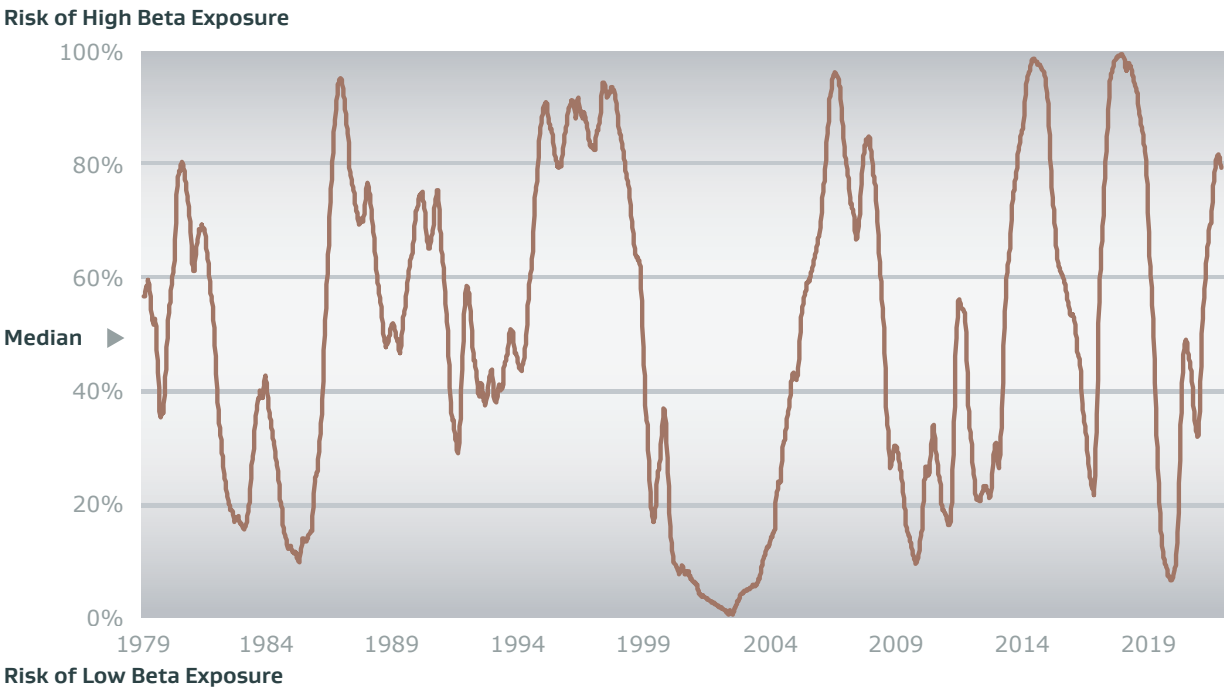
Index efficiency measures the extent to which more or less market beta exposure is required to produce a more efficient portfolio than the index. It indicates a greater likelihood for increased market volatility when at extreme values, especially when used in combination with the other risk metrics.

Stock market indexes are typically not the most efficient portfolios from a risk-return perspective, as they are generally constructed without taking into consideration stocks' volatilities or correlations. While the degree of risk-return efficiency of the index portfolio varies over time, it can be improved upon using optimization techniques which do consider these measures.

At times of high index efficiency, typically associated with lower levels of market volatility and rising markets, it is necessary for an optimized portfolio to maintain a relatively high market beta exposure in order to improve upon the index's risk-return efficiency (e.g., during the mid-1990s, 2007 and the end of 2014). Such periods carry the risk of a higher market beta exposure should there be a sharp market drawdown.

At times of lower index efficiency, often associated with higher levels of market volatility and falling markets, the improvement in risk-return efficiency can be readily achieved with lower levels of market beta exposure (e.g., early 2000s and 2009). At such times the dangers of a lower beta exposure revolve around the risk of lagging the market should there be a sharp market rally.

FIGURE 4
INDEX EFFICIENCY OF S&P 500® INDEX
Percentile ranks for the period ended December 31, 2021



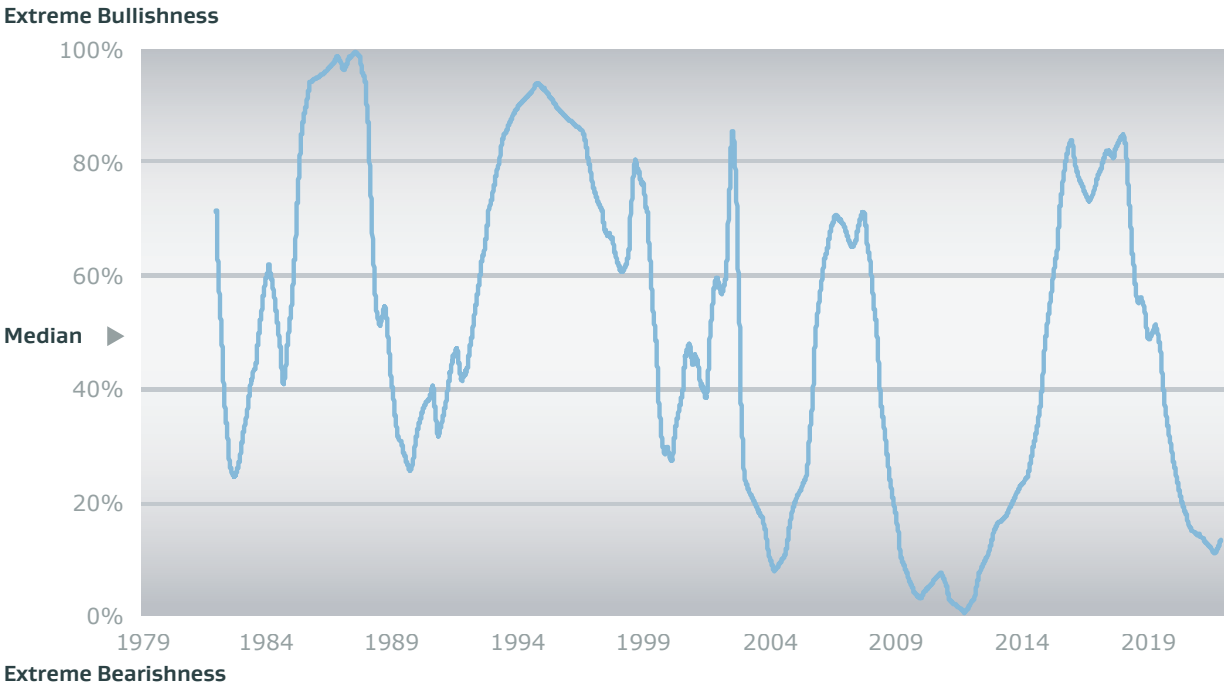
Skewness of Returns
How fat are the tails?

Skewness measures the asymmetry of index returns around the mean value. Investors tend to feel more urgency to react to unexpected negative news than to positive surprises, so logarithmic returns tend to be more heavily skewed towards returns below the mean (negative skewness). For example, an arithmetic return of -20% tends to occur more frequently than an arithmetic return of +25%[1].

As shown in Figure 5, when investors become irrationally exuberant, market returns tend to become less negatively skewed or, even briefly, positively skewed (e.g., beginning of 1987 and mid 1990s), which supports the potential for an increased likelihood of a significant market dislocation.

Conversely, very low levels of skewness often coincide with the market shock itself, and eventually manifest themselves as increased market dislocation with positive outcomes (e.g., early 2004 and following the Global Financial Crisis in 2009).

FIGURE 5
SKEWNESS OF RETURNS FOR S&P 500® INDEX
Percentile ranks for the period ended December 31, 2021



[1]The arithmetic returns -20% and +25% are paired because (1-20%)(1+25%)=1.

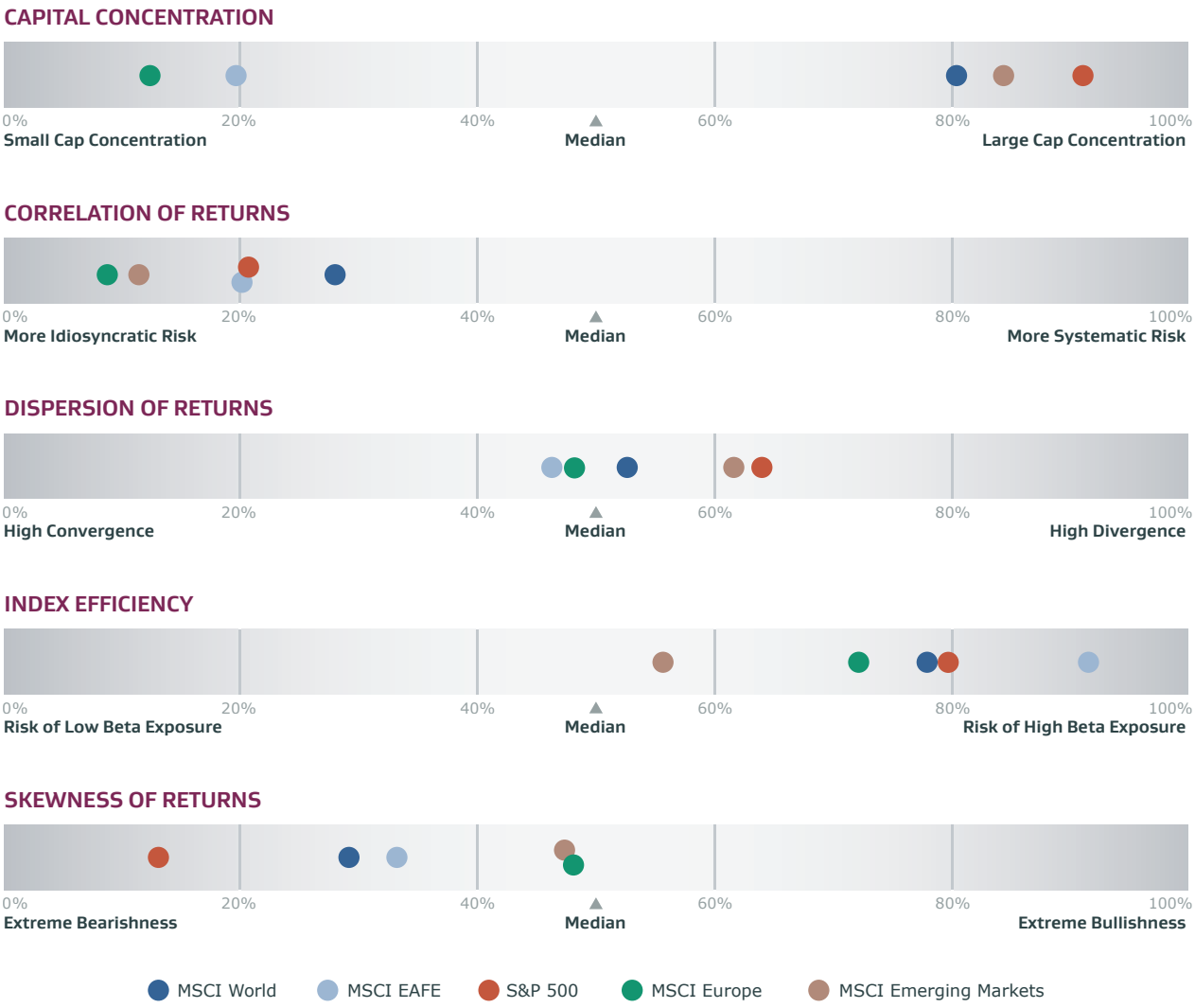
Application

We find that our equity market stress metrics are reliable indicators of strain across many market indexes. For all of these measures, market stress is determined when the percentile value is unusually low or high, which generally is associated with an increased likelihood of market dislocation. Simply put, the greater the collection of metrics that are at extreme values, the greater the strain in the market.

In Figure 6, each risk metric is expressed in a percentile range relative to an equity index (i.e., an investor's benchmark). Values that fluctuate near the median (50th percentile) indicate zero or no strain along that dimension; values which are unusually low or high (i.e., typically below the 20th or above the 80th percentile, respectively), or are rapidly crossing through the median level, are signs of possible market strain. We have calibrated the metrics to a time horizon of up to a year to facilitate early-warning within an equity index.

FIGURE 6

GLOBAL EQUITY INDEX VALUES OF RISK METRICS AS OF DECEMBER 31, 2021



Conclusion

In this paper, we introduce a collection of reliable indicators to help identify an increased likelihood of market instability. These indicators provide investors and plan sponsors with additional insight to complement other conventional metrics (e.g., valuations, sentiment, economic) that they might use for making informed market decisions with their capital.

Most insight is gained when the risk metrics are collectively at extreme levels or changing most rapidly: investors should avoid drawing conclusions by observing each metric in isolation. Additionally, the greater the deviation from the median and the longer this deviation persists, the more likely we will observe an abrupt return to long-term averages with increased market volatility. This is often associated with negative outcomes for equity markets, although signs of strain do not always precede a market crisis. Intervention by central banks, policy decisions, and economic conditions can provide a soft landing by disarming the risk.

Overall, when market stress is low, investors can focus on achieving their growth mandate with greater confidence, and greater oversight of their risk budget. Even when tail-risk is elevated, investors can maintain an equity allocation as long as they add appropriate downside protection. Additionally, when there is a greater likelihood of market risk, approaches to active management that emphasize risk controls and navigate varying levels of market volatility are more conducive to a successful investment experience. Similarly, passive management as a whole may present unpleasant surprises as it digests the suppressed volatility that eventually becomes realized volatility.

The Intech Equity Market Stress Monitor, in combination with more conventional metrics of risk, helps highlight an increased likelihood of tail-risk events, which ultimately allows investors and plan sponsors to make more informed asset allocation decisions to protect their portfolios.

Technical Appendix

For those who like mathematics, following is some insight into the calculations used in the Intech Equity Market Risk Monitor. On a daily basis, we calculate new percentile ranks for each metric value. For more information, please contact Intech directly.

Capital Concentration

We define index capital concentration as exponentially smoothing on a daily basis the fraction

$$C = \frac{\text{(market capitalization in top } n \text{ stocks)}}{\text{(market capitalization in top } N \text{ stocks)}}$$

where n and N are selected appropriately for each index (n is smaller than N). For example, in the S&P 500® Index, n and N represent about 50 and 400, respectively.

Correlation of Returns

We define index correlation by first converting the daily, logarithmic, absolute, total returns for all of the index constituents over the past 252 days to monthly versions, by combining them in 12 groups of 21 returns each. Assuming that R is the matrix of monthly returns, where rows corresponds to stocks, and columns to months, we then compute the covariance matrix via

$$C = \frac{1}{M-1}\left(R \cdot R^T - \frac{1}{M}(R \cdot E) \cdot (R \cdot E)^T\right)$$

where M=12 is the number of months, T indicates the transpose of a matrix, and E is the vector of all ones. Next, we compute the correlation between any two stocks via

$$\varrho_{ij} = \frac{C_{ij}}{\sqrt{C_{ii}\,C_{jj}}}$$

Finally, the series is smoothed using exponential and notch filters.

Dispersion of Returns

We calculate index dispersion by exponentially smoothing on a daily basis the difference

$$d = \ln\left(\sum_{i=1}^{n} m_i(t)e^{r_i(t)}\right) - \sum_{i=1}^{n} m_i(t)r_i(t)$$

where the m's are the normalized index weights, and the r's are the logarithmic returns of the index constituents.

Index Efficiency

Index efficiency refers to the index's level of performance efficiency (risk-adjusted returns). Performance efficiency for an index varies over time through risk regimes and may be improved by reallocating index constituent weights based on their relative volatility and correlations characteristics – a more optimized portfolio. The index efficiency metric is an asset-weighted beta of an optimized portfolio that attempts to minimize absolute risk subject to outperforming the index over the long term. The objective for this optimized portfolio is that for The Intech Adaptive Volatility Equity strategies.

Skewness of Returns

We compute the index skewness metric by first generating the monthly returns for the index in the same manner as the correlation computation, except that three years are used instead of one. Then, the non-normalized skewness is computed for the sample of 36 observations. Finally, the series is smoothed using exponential and notch filters.

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