Quant Lab

Equity Dispersion

Tages Capital
39 St James's Street, London, SW1A 1JD
T: +44 (0)20 3036 6051

www.tagescapital.com
clientservices@tagescapital.com

Authors

Berouz Fatemi
Head of Quantitative Strategies
Tages Capital

Sébastien Krol
Portfolio Strategist
Tages Capital

Overview

The persistent low rate environment has once again increased the popularity of structured products amongst retail investors. This has resulted in an improvement in the volume of single stock options transactions, especially in the US. Relatively cheap single stock options in comparison to stock index options has, in turn, generated more interest in dispersion trading amongst banks, hedge funds and other derivatives traders.

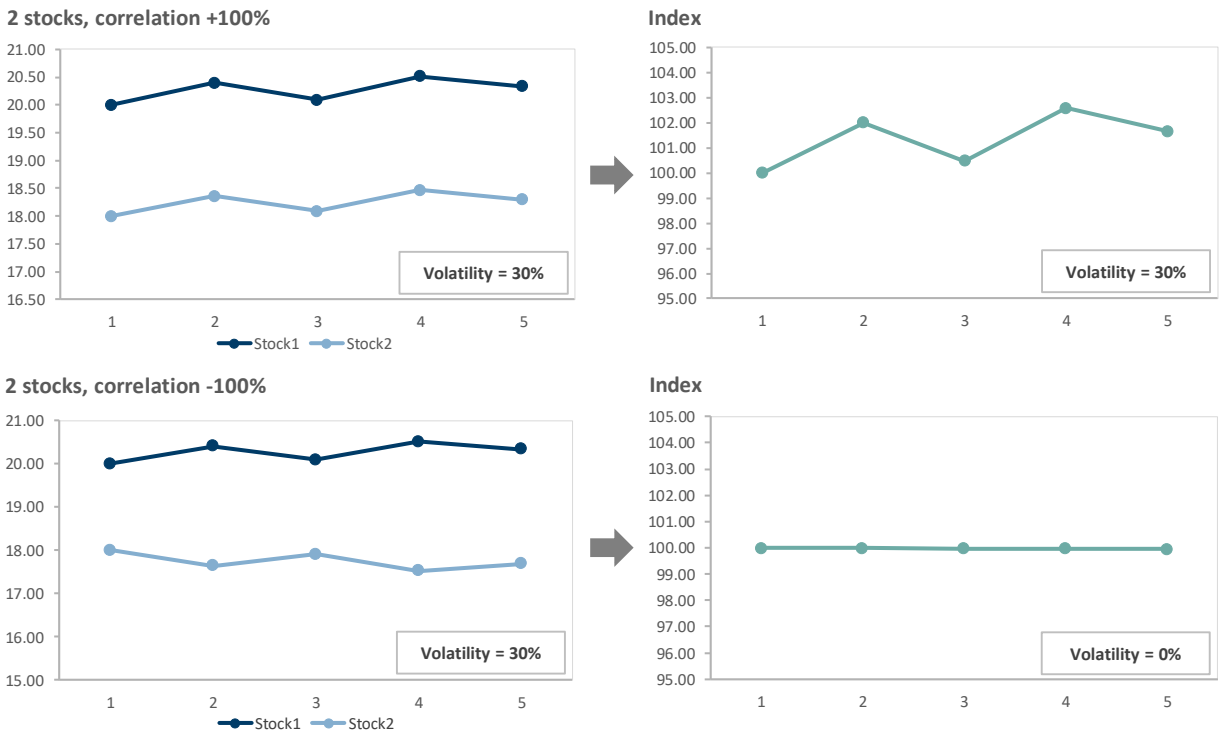
For many years, investors have viewed dispersion trading as an effective strategy to take advantage of a structural imbalance in the equity options market. A dispersion trade entails selling volatility (i.e. selling options) on an index against buying volatility on the index's constituents. Because dealers are generally short volatility on indices (due to investors buying options for portfolio protection) and long volatility on individual stocks (due to investors' covered call-writing strategies and structured product purchases), index options have historically had a higher implied volatility premium than their single-stock counterparts.

Dispersion can be implemented through options, variance or volatility swaps. It can also be executed in many forms such as vega- or theta- neutral, using different maturity options and in various types of bespoke baskets of single stocks. Different implementations offer a wide range of exposures and outcomes that investors can design according to their portfolio requirements.

Basic Concepts

Going short index implied volatility and going long single-stock implied volatility is known as a dispersion trade. Correlation exposure which is historically achieved through such dispersion trades is a measure of the tendency of share prices to move together; its most common incarnation is seen in the "diversification effect" in portfolio theory. From basic portfolio theory, in a portfolio of stocks, the return of the portfolio is additive, although the risk (or volatility) is not; an observed benefit of diversification is the reduction in the volatility of a portfolio. The volatility of an index is capped at the weighted average volatility of its constituents. Due to diversification (or less than 100% correlation), the volatility of indices tends to trade significantly lower than its constituents. The VCA (Volatility Correlation Analysis) function on Bloomberg provides investors with high level analysis of this on major stock indices.

Fig 1. Impact of Single Stock Correlation on Index Volatility



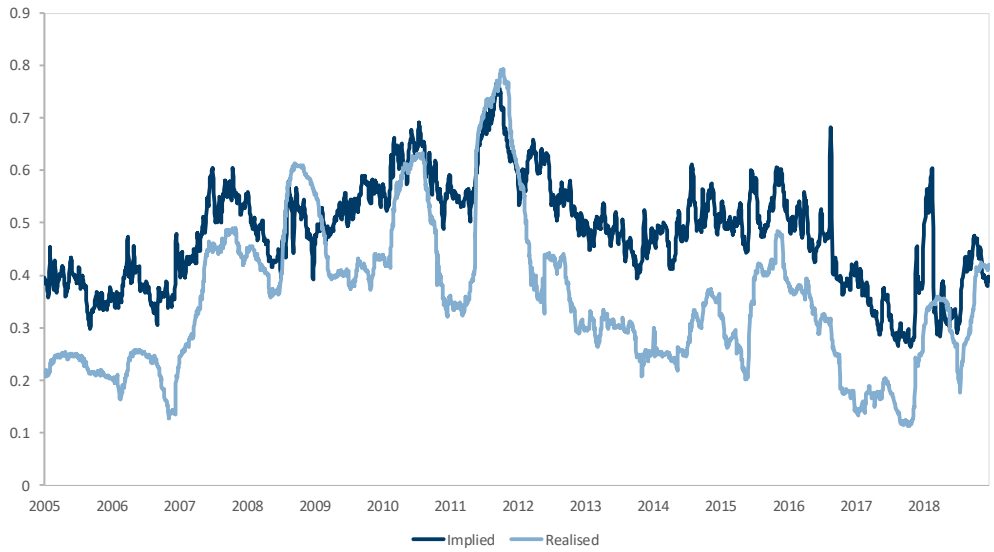
Source: Bloomberg

Flows from retail structured products as well as call-overwriting funds provide a structural supply of single stock volatility in the market resulting in a relative cheapness of single stock volatility compared to the index implied volatility. The strategy looks to capture the historically observed market behaviour of index volatility trading rich relative to constituent stock volatility; this strategy aims to capture the sale of this "rich" volatility, whilst eliminating the significant risk of a short exposure to volatility.

Basic Concepts

Generally, a noticeable trend has been for implied correlation to trade rich relative to realised correlation, as a consequence of index implied volatility trading rich relative to the constituent single-stock volatility. This thesis supports a short trade on the index volatility against a long position on the single stocks; as the correlation is less than one, a given increase in single-stock volatilities will lead to a smaller increase in index volatility levels.

Fig 2. SPX Implied & Realised Correlation (6 months) [1]



Source: Tages Capital

An investor can gain exposure to the implied vs. realised correlation spread by trading index volatility vs. single stock volatility. A short index vega (volatility) position vs. a long single stock vega position creates a short correlation exposure for the investor. A short correlation trade is typically termed a long dispersion trade.

Fig 3. Dispersion Trading

Dispersion		Correlation	Index Leg	Stock Leg
Long dispersion	=	Short correlation	Short index volatility	Long stock volatility
Short dispersion		Long correlation	Long index volatility	Short stock volatility

Source: Tages Capital

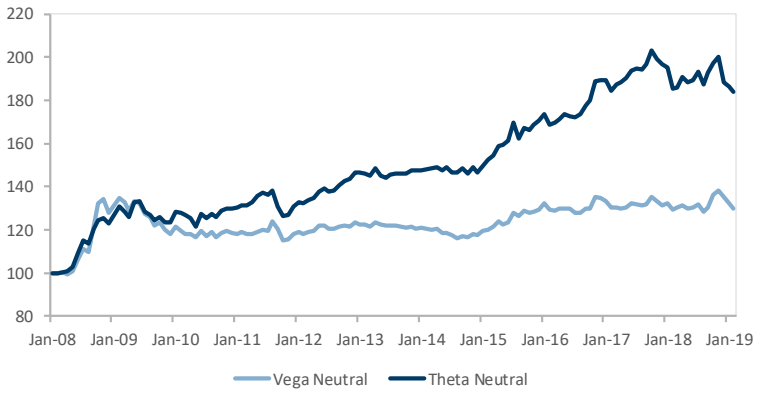
[1] Index correlation (square root) can be approximated by the ratio between the index volatility and the average of single stock volatilities: $\sqrt{\rho} = \frac{\sigma_{Index}}{\sum w_i \sigma_i}$

Dispersion Schemes

There are two main types of dispersion trades: vega-weighted and theta-weighted dispersion trades. Each of these trades is driven by the apparent difference in their weighting schemes.

- **Vega-weighted dispersion**: the vega notional of the index is equal to the total vega notional of the single stocks. This dispersion strategy has both correlation and volatility exposure (i.e. a long vanilla dispersion is short correlation, but is also long stock volatility).
- **Theta or correlation-weighted dispersion**: the total vega notional of the single stocks is scaled by the square root of the index correlation. This means there is a smaller single-stock vega leg compared to the vega weighted approach (single-stock volatility is larger than index volatility, so it must have a smaller vega for vega × volatility to be equal).

Fig 4. Historical Performance: Vega Neutral vs. Theta Neutral



Source: Citigroup

There is usually a preference for a vega neutral implementation in a low correlation / low volatility environment. The largest driver of performance for this strategy is changes in implied vs. realised volatility in the market, where the correlation premium (implied-realised correlation) acts as a financing leg for the maintenance of the long volatility position. A theta neutral implementation is preferred in a high correlation / high volatility environment. This can be explained by the fact that the largest driver of performance for a theta neutral dispersion trade is the implied-realised correlation spread, where such correlation premium (implied-realised correlation) gets effectively multiplied by the average realised single stock's volatility.

Fig 5. Implementation: Vega Neutral vs. Theta Neutral

		Vega Neutral	Theta Neutral
Long/short relative weighting (Vega notionals)	*Index Vega notional:*	N^{vega}	N^{vega}
	Single stocks notional:	$N_i^{vega} = w_i \times N^{vega}$	$N_i^{vega} = w_i \times N^{vega} \times \sqrt{p}$ with $\sqrt{p} = \frac{k_1}{\sum_i w_i \times k_i}$ k_1 the index strike k_i the single stocks strikes

Source: Tages Capital

Implementation: Instruments

The development of pure volatility instruments such as volatility and variance swaps in the 1990s, allowed investors to take more stable exposure to the correlation premium by eliminating the path-dependency issue which exists in volatility trading with listed options. By ensuring consistent volatility exposure on both legs of the trade, variance swap dispersion can help investors better isolate exposure to correlation and avoid potentially large net volatility positions. Examples of commonly utilised instruments are listed below.

Options

- ✓ Implementation through puts / calls / straddles / strangles. Either listed or OTC
- ✓ Can be traded in a systematic strategy
- ✓ Can be executed on major markets

Variance swaps

- ✓ Variance swap (or var swap) is a contract that enables investors to trade future realised variance against current implied variance
- × Less liquid and only available in the US

Volatility swaps

- ✓ Volatility swap (or vol swap) is a contract that enables investors to trade future realised volatility against current implied volatility
- ✓ Can be executed on major markets

Exotic options

- ✓ Exotic options enable investors to engage in dispersion trades involving options on single stocks against options on a basket of stocks (instead of an index)
- × Much less liquid and can usually only be unwound with the initial counterparty

Dispersion has been traded in the past using variance swaps; however since the decline in the liquidity of single stocks variance swaps, dispersion using equity options has become the standard correlation vehicle in the equity derivative world.

Trading dispersion through options might sound somewhat simplistic, but it is a cheaper solution than trading swaps or OTC products and is often more liquid. The other downside to variance and volatility swaps is that market makers tend to impose a capped pay-out for swaps of about 2.5 times the strike price. This caused some large losses in 2008 which resulted in diminishing interest in variance and volatility swaps.

For investors looking to trade dispersion via listed options, path-dependency dynamics are a major issue. Depending on the evolution of underlying security prices, a dispersion investor could end up with a significant net volatility position between the legs. This is the reason why trading dispersion with listed options has a "noisier" P&L than doing so with pure volatility instruments.

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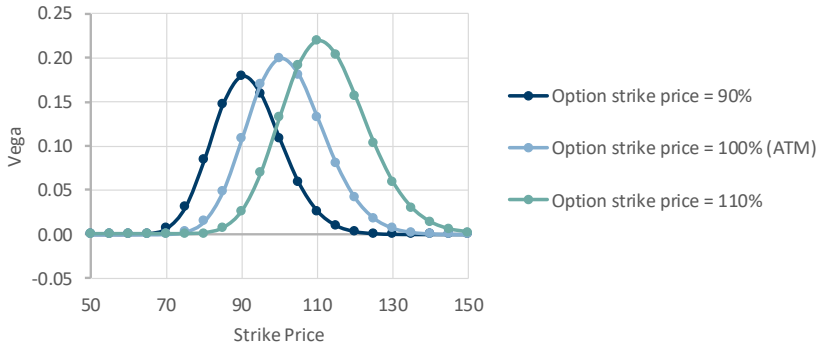
Path Dependency of Options

Path dependency of options refers to the fact that an option's Greeks (vega, gamma, etc.), change as market moves away from the initial strike. The chart below illustrates how the vega exposure of a vanilla option varies with strike. In this case, we see a 3m ATM option, showing how the volatility exposure rapidly changes as the share price moves away from strike.

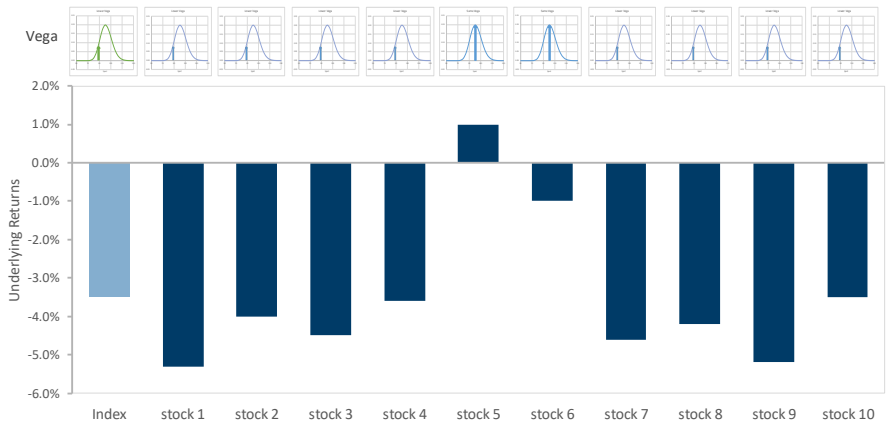
Fig 6. Volatility Exposure (3m option)



Source: Tages Capital

Trading dispersion through options, often executed through listed straddles, has an interesting path dependency dynamic which could be an issue at times when individual stocks trend in the opposite direction to the index. This could result in unchanged index performance whilst the stocks have deviated significantly from their original strike level, meaning we would no longer capture "correlation". This could be remedied by executing a new set of at-the-money options at regular intervals (monthly, for example). During sharp sell-offs, this path dependency feature can be exploited by investors. In such market conditions, the index could move far away from the average strike in the portfolio and thus lose most of its volatility features (gamma and vega). Individual stocks are expected mostly to follow the index away from their strike, but some might be more resistant and still trade close to their strike, exposing the strategy to long gamma as in the chart below. Also as individual stocks usually have higher implied volatilities than indices, they generally maintain their realised volatility exposure over a wider range of prices.

Fig 7. Volatility Exposure: Index vs. Individual Stocks



Source: Tages Capital

Dispersion Styles

There are various ways to trade dispersion. Investors can trade via a process driven implementation, or may want to express their own view on the behaviour of the index correlation and its components.

- **Full dispersion**: Options on all single stocks in an index are purchased against an option on the index respecting individual stocks weights. In practise, this type of trade is focused primarily on indices with smaller number of constituents such as EuroStoxx 50.

- **Quasi-full dispersion**: For some indices, not all the constituents are tradable (or the index contains too many stocks). It is common practice for these indices to take into consideration only a percentage of the market cap, looking at the vega notional of each stock scaled by the adjusted weight in the index (e.g. SPX top 50 dispersion) to 'approximate' the index. Consequently, the dispersion effect is quasi-replicated since the majority, but not all, of the capitalisation is traded.

- **Bespoke dispersion**: investors might want to choose the basket of single stocks on which they place their dispersion trade. In this case, not all the names may be in the related index, which makes it difficult to weight the stock options as in the index. However, this type of trade allows the investors to tailor their exposure along with their view on future correlation behaviour and the relative cheapness of individual stock volatilities. Bespoke implementations allow investors to express investment themes by selectively exposing their strategy to a specific sector in order to benefit from intra-sector volatility or sector rotation. Or, for example, interest rate sensitive strategies can be positioned for moves in interest rates, regardless of the direction.

- **Geometric dispersion**: This style involves selling volatility (often in exotic shape) on a bespoke geometric basket of stocks and buying back volatility on the individual components. This relative value strategy plays the mean reversion between the realised volatility of both single stocks and their geometric average compared to implied volatility levels. Geometric dispersion can be traded via variance swaps, volatility swaps or options.

Conclusion

Dispersion trades can be implemented in very simple or complex ways with a diverse range of outcomes. The most efficient implementation uses listed options, executed at different intervals such as weekly or monthly, minimising the path dependency issue. As noted previously, the vega neutral weighting methodology provides the investor with a residual long vega exposure. This is the implementation that we are most interested in for the Paladin UCITS Fund as it provides the portfolio with inexpensive downside protection.

Most investors engage in dispersion strategies as an arbitrage between cheap single stock volatility and rich index volatility, aiming to benefit from the risk premia carry offered by a theta neutral strategy. Most bespoke implementations have been also designed to pick the cheapest single stock volatilities against a basket or index, maximising the embedded carry.

Bespoke structures need to be executed on both sides of the trade (opening and closing a position) with a single bank counterparty. These may seem very simple and intuitive, but equity market and dispersion trading experience is needed to distinguish the intricacies of sector rotation and other nuances.

We hope this note can help you better understand the various forms and shapes of this interesting strategy and its often needlessly complicated terminology.

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