CBOE RISK MANAGEMENT CONFERENCE EUROPE

TRADING CROSS-ASSET VOLATILITY & CORRELATION

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Directional strategies

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Financial Engineering

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Portfolio Manager,
36 South Capital Advisors LLP
I) Thoughts about cross asset correlations

A. Long term vs Short term correlation using variance swap replication [TU]
B. Cross-asset correlation with Hybrid options and covariance swaps [KAB]
C. Correlation and Volatility have the same impact on portfolio volatility: [NJ]

Equity/rates correlation is unstable and distorts traditional multi-asset portfolios.

II) Managing Volatility and correlation distortion in a negative interest rates environment

A. Nash Equilibrium, central bank and social changes impacting the Expected utility... [NJ]
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C. How do you deal with tail risk? unknown unknowns [NJ]

III) Sourcing volatility efficiently: Production Innovation and liquidity constraints

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Conclusion: Structured products’ Tail wagging the Correlation Dog
Structured products distortion on cross asset correlation, volatility and convexity .. [KAB]
A few words on correlation

- Time varying property of Cross-asset correlation of volatility trading
- How to deal with high correlation?
- Term structure of correlation: the difference between long-term correlation and short-term correlation
Multi asset short variance swaps
Volatility assets become more correlated after 2008
Highly correlated assets:
- Long Stock indices future
- Short Equity variance swaps
- Short Volatility Indices future
- Long CDX (IG, HY)
- 2 zones: US/EU
Equity related: equity neutral (per zone) correlation matrix
Term structure of correlation

Short term correlations

Long term correlations
Correlation arbitrage

\[
\frac{1}{2} \text{Ema}_{T/2}(R_A \text{Ema}_T R_B + R_B \text{Ema}_T R_A) = \text{Ema}_T R_A \text{Ema}_T R_B - \frac{1}{T} \text{Ema}_{T/2}(R_A R_B)
\]

\[\rho_L \text{ long-term correl} \quad \rho_S \text{ short-term correl}\]

Tail Protection for Long Investors: Trend Convexity at Work
We should be aware of the evolution of cross asset correlation,

Some main factors could be removed using simple concept of beta-hedging to gain back the diversification,

The term structure of correlation is far from being flat, which could be used as an alpha strategy by using correlation arbitrage
CROSS-ASSET CORRELATION WITH HYBRIDS

Investment case for hybrids:
- A melting pot of derivative parameters (correlation, volatility, forwards)
- Isolate specific outcome in joint probability distribution
- Leveraged, yet with limited risk
- Exotics book supply & demand distortion

Correlation drives the discount

- “Worst-of” options provide the most discount.
- % discount vs vanilla assuming cross-asset correlation of 0%:
  - Worst-of option: 70%,
  - Contingent option: 50%
  - Basket option: 30%

Source: SG CIB Financial Engineering
TRADING SYNTHETIC COVARIANCE SWAP

COVARIANCE = VOLATILITY X CORRELATION

- A three leg trade where:
  - Long 1 x VarSwap Compo into composite currency
  - Short \( w_{qto} \) x VarSwap quanto on the index
  - Short \( w_{fx} \) x Currency VarSwap

\[
P & L = \left[ \frac{\text{Var}_{\text{compo}} - K_{\text{compo}}}{2K_{\text{compo}}} \right] - w_{qto} \left[ \frac{\text{Var}_{\text{qto}} - K_{\text{qto}}}{2K_{\text{qto}}} \right] - w_{fx} \left[ \frac{\text{Var}_{\text{fx}} - K_{\text{fx}}}{2K_{\text{fx}}} \right]
\]

- Proportions are determined so that the structure is VAR neutral \( \Rightarrow \) a pure COVAR trade

\[
w_{qto} = \frac{K_{\text{qto}}}{K_{\text{compo}}} \quad \text{and} \quad w_{fx} = \frac{K_{\text{fx}}}{K_{\text{compo}}}
\]

- And your final P&L can be written as:

\[
P & L = \frac{(\text{RealisedCovar}_{\text{index, fx}} - \text{ImpliedCovar}_{\text{index, fx}})}{K_{\text{compo}}} \Leftrightarrow \text{Covar swap}
\]

FTSE/ GBPUSD Covariance swap Backtest

THE VALUE OF YOUR INVESTMENT MAY FLUCTUATE. THE FIGURES RELATING TO SIMULATED PAST PERFORMANCES REFER TO PAST PERIODS AND ARE NOT A RELIABLE INDICATOR OF FUTURE RESULTS. THIS ALSO APPLIES TO HISTORICAL MARKET DATA.
Alexander Calder, entropy and correlation

Pan asset class rolling three year weekly correlation
Proxies are: S&P500, USGG10, DXY, CCI


Source: Calder Foundation, New York; Bequest of Mary Calder Rower, 2011
Low volatility – the great educator

The floor (flaw?) in volatility control by correlation

Volatility moves to anticipate future low realised volatility

Probable of rapid volatility expansion tends to 1

Low volatility leads to greater amount known about unknowns

% Change in Volatility is greater off a lower base (Vol of Vol)

ZERO, anything that moves causes volatility, and therefore approaching zero this scenario is approximated

Base rate volatility is known unknowns, either we know little is unknown or accept low premium

Source: Bloomberg as at 9 Sep 2016

Source: 36 South Capital Advisors LLP

Low volatility – the great educator

SPX vs 10 %Volatility Control Index

Volatility moves
to anticipate
future low
realised
volatility

% Change in
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greater off a
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Source: 36 South Capital Advisors LLP

Source: Bloomberg as at 9 Sep 2016

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Volatility regimes: Correlation and volatility

Drift and Brownian volatility = 0
Correlation = 1

Drift volatility = 0 correlation =1

Any change in volatility to this state, will by definition cause a reduction in correlation

SPX as Perpetuity

US 10 Year @ 1.55%
PE ratio today (approx. 20.5)
4.9% earnings yield

PE ratio in 2012 (approx 13)
7.7% earnings yield

Effective Yield (1/PE)

Source: Goldman Sachs 360; 36 South Capital Advisors LLP

Source: 36 South Capital Advisors LLP
Geometric mean, and variance no proxy for risk

Definition of Investment “Geometric Zeros”

Geometric Zero of Capital: achieved by sufficient non-performance (erosion) of capital such that expected rate of return for duration of investment time horizon no longer reinstates capital


Source: 36 South Capital Advisors LLP

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Factors affecting the gradient of the zero line
Where correlation is an unsustainable rescue

Geometric Zero of Capital: achieved by sufficient non-performance (erosion) of capital such that expected rate of return for duration of investment time horizon no longer reinstates capital

Winter White Dwarf Hamster

Life expectancy: 2 years

Source of charts: Bloomberg as at 9 Sep 2016

EURIBOR

EUR Debt - Social overhang
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Equity / Rates Correlation is Convex!

Challenges for multi-asset portfolios as Efficient Frontier shifts due to correlation shifts (Harry Markowitz)

Multi-asset portfolio are now more volatile and subject to correlation shocks

Need for new assets with more stable correlation against risky assets = volatility or variance swaps (equity, fx, rates, credit, commodities).

Building Team Spirit Together

Source: SG CIB Flow Strategy & Solutions
Pistols at dawn
Nash equilibrium proves necessity for a convex response

Nash equilibrium for taking a shot when: \[ \sum \sigma P'(d) + \sigma P(1 - d) > 1 \]
Long volatility strategy in a portfolio
Volatility paid vs expected outcomes

Nash equilibrium probability of hit vs % move

SPX volatility
Days from peak to trough

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Source of charts: Bloomberg and 36 South Capital Advisors as at 9 Sep 2016
Normal correlation vs Tail correlation
The risk of the long and short VIX position are equal

Volatility (standard deviation) does not pick this up!

Idea: risk premia = compensation for taking on a negatively skewed position

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Risk Premia: Asymmetric Tail Risks and Excess Returns
Classical diversification

Volatility: Second moment

Correlation between A and B

Metric of A+B
High moment diversification

[Graph showing the relationship between correlation of A and B and a metric of A+B, with labels for Volatility: Second moment and Third moment.]
Allocation solution “Tail risk Parity”
- Define independent sources of tail
- Equally allocation on tail scenario
- Combining tail-anti-correlated strategies as natural hedge:
  - Trend following (positive skew)
  - Risk premia (negative skew)
### Natural hedge with convexity of trend following

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![Graph showing natural hedge with convexity of trend following](image)
AGENDA

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V1 OF VOL: STRANGLE ON VSTOXX / VIX SPREAD

V2X – VIX term Structure

Var upward vs Vol downward slopping TS

Volatility of volatility term structure

Spread of term structures consistently downward slopping

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Source: Bloomberg, SG CIB Flow Strategy & Solutions

Past performance is not a reliable indicator of future returns.
US10Y CMS VS SPX VARIANCE SWAPS

PnL Long USD 10CMS vs SPX VAR Swap

Source: Bloomberg, SG CIB Financial Engineering
SPX VARIANCE SWAPS CONTINGENT ON USD 10Y < ATM + 50BPS

PnL Long USD 10CMS vs SPX VAR Swap

Source: Bloomberg, SG CIB Financial Engineering
SPX VS SX5E CORRIDOR VARIANCE SWAPS

Source: SG CIB Flow Strategy & Solutions

Past performance is not a reliable indicator of future returns.
Variance swap replication

- Short variance swap payoff:
  \[ \sigma_t^2 - \frac{1}{T} \sum_t \log\left(\frac{S_{t+1}}{S_t}\right)^2 \]

- Static \(1/K^2\)-weighting option portfolio at time 0:
  \[-\frac{2}{T} \left( \int_{S_0}^{S_0} \frac{1}{K^2} \text{Put}_K + \int_{S_0}^{S_0} \frac{1}{K^2} \text{Call}_K \right) \]

- Dynamic hedging:
  \[
  \text{position} = 2\left( \frac{1}{S_0} - \frac{1}{S_t} \right), \quad \text{trade} = 2\left( \frac{1}{S_{t-1}} - \frac{1}{S_t} \right)
  \]

- Strongly related to Black-Scholes world, replicating a log-contract,
- No distinction between long-term and short-term volatilities,
- VIX is considered as implied value of average daily volatility
Simple variance swap

Straddle payoff:

\[
Pnl_{[0,T]}^{Straddle} = |S_T - S_0| - (C_K + P_K) = |\Delta_{[0,\tau]}| - \text{OptionPrices}^{T \sigma^2_{[0,\tau]}}
\]
Simple variance swap

- Strangles payoff:

\[ Pnl_{[0,T]}^{2Strangles} = \Delta^2_{[0,T]} - T\tilde{\sigma}^2_{[0,T]} \]

- Simple trend payoff:

\[ Pnl_{[0,T]}^{2Trend} = \Delta^2_{[0,T]} - \sum_t \Delta_t^2 \]

- At the day 0, we have 2 ways to buy long-term variance \( \Delta^2_{[0,T]} \), which provides a positive skew:

- On options market by buying a static uniform portfolio, pay a static price which is quoted at time 0: \( T\tilde{\sigma}^2_{[0,T]} \).
- On "future" market by applying simple trend strategy, pay a floating price, which is only fully determined at \( T : \sum_t \Delta_t^2 \).
Variance swap = Long-term variance arbitrage := Trend Anomaly + Option Premium

- Black-Scholes-free, no assumption on price/volatility processes,
- Big distinction between long-term and short-term volatilities: anomaly of trend,
- VIX is implied value of long-term volatility,
- Option premium: Uniform strangles portfolio
- Hedging frequency defines the timescale of volatility that we want to trade.
The future of volatility

**Gradients in volatility - the fast collapses after an “event”**

**THE FAST 30 – Days from peak to trough**

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*Source of charts: Bloomberg and 36 South Capital Advisors as at 9 Sep 2016*
Bull case for volatility

Source of charts: Bloomberg and 36 South Capital Advisors as at 9 Sep 2016
I) Thoughts about cross asset correlations

A. **Long term vs Short term correlation** using variance swap replication [TU]
B. **Cross-asset correlation** with Hybrid options and covariance swaps [KAB]
C. **Correlation and Volatility** have the same impact on portfolio volatility: [NJ]

Equity/rates correlation is unstable and distorts traditional multi-asset portfolios.

II) Managing Volatility and correlation distortion in a negative interest rates environment

A. **Nash Equilibrium**, central bank and social changes impacting the Expected utility... [NJ]
B. **Alternative Beta** Strategies and Tail risk parity approach ... [TU]
C. **How do you deal with tail risk?** unknown unknowns [NJ]

III) Sourcing volatility efficiently: Production Innovation and liquidity constraints

A. Thoughts about **product innovation** [KAB]
B. **Simple volatility trading** with Black-Scholes-free-variance-swap... [TU]
C. Challenges and opportunity in sourcing volatility across asset classes [NJ]

**Conclusion: Structured products’ Tail wagging the Correlation Dog**

Structured products distortion on cross asset correlation, volatility and convexity .. [KAB]
DVEGA/DSPOT (VANNA) AND DVEGA/DVOL (VOMA) DYNAMICS OF AUTOCALLS
In Europe, issuances have also slowed significantly since Sep15.

Monthly vega from SX5E autocallable is now around $10mn (vs ~$20mn in 2014-2015)
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