

Market Inter-Relationships: Cash Equities and Derivatives

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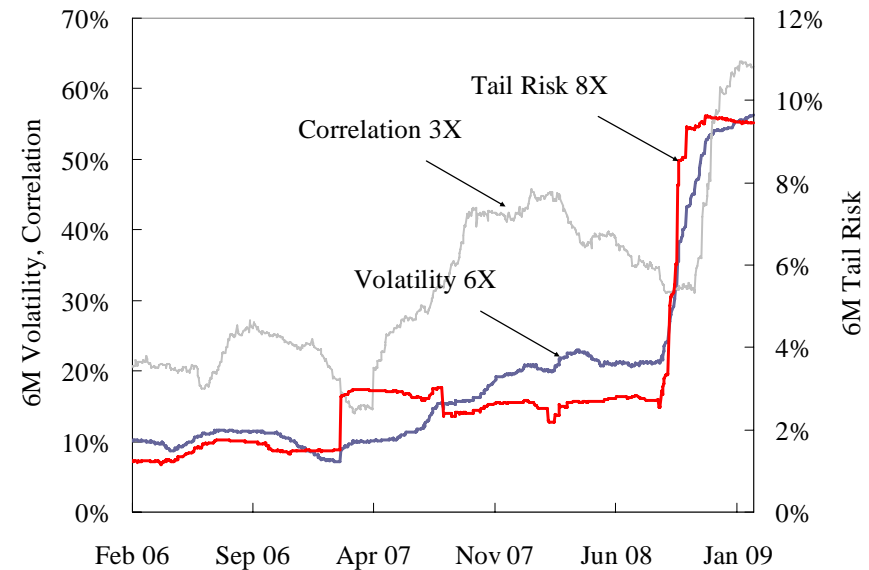
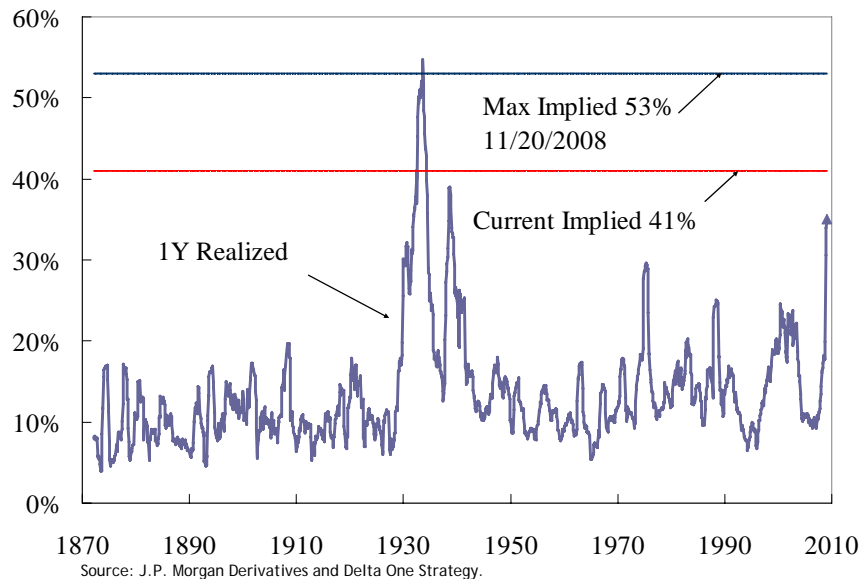
Market Inter-Relationship: Cash Equities and Derivatives

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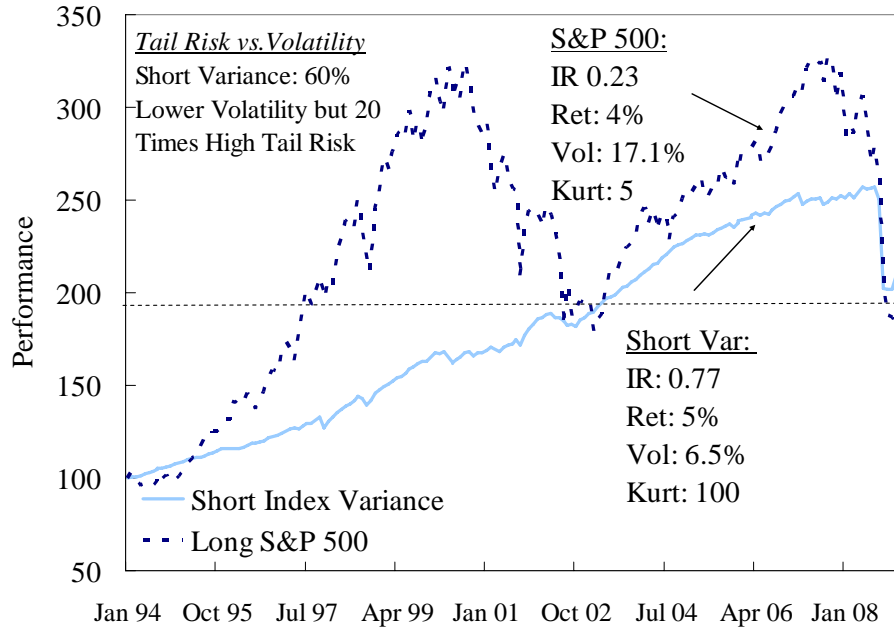
2008/2009 Crisis - Changes Brought by Market Volatility

- 2008/2009 Crisis started in the financial sector, and caused broad de-leveraging and a decline in asset prices.
- Positive feedback loops caused an increase in volatility of all asset classes with equity volatility reaching levels not observed since the Great Depression (Figure below left, 1Y S&P 500 volatility over past 140 years)
- Surge in volatility, correlation, and tail risk (Figure below right, 6M S&P 500 past 3 years) has brought changes in ways investors analyze risk and use derivatives products. In our view, the important implications of the crisis are:

- 1) Re-evaluation and re-pricing of Tail Risk
- 2) Change in the Usage of Derivative Products
- 3) Focus on the Inter-Relationship between Cash and Derivative Markets - transaction in derivative markets can have significant impact on cash markets and vice versa



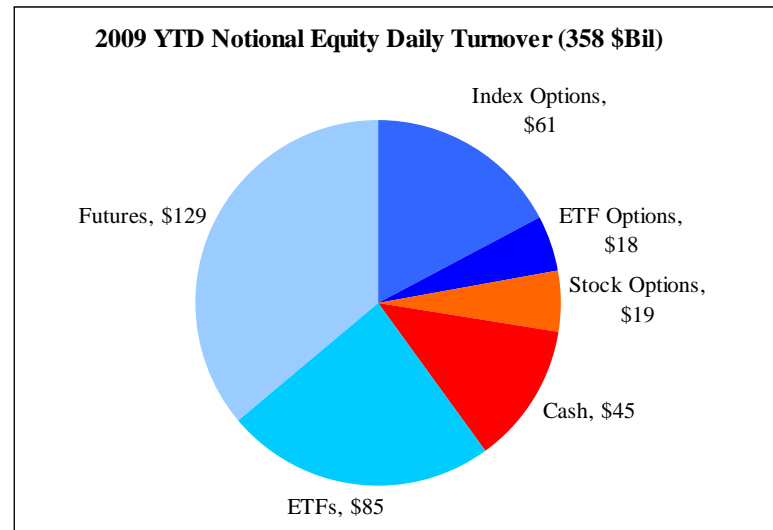
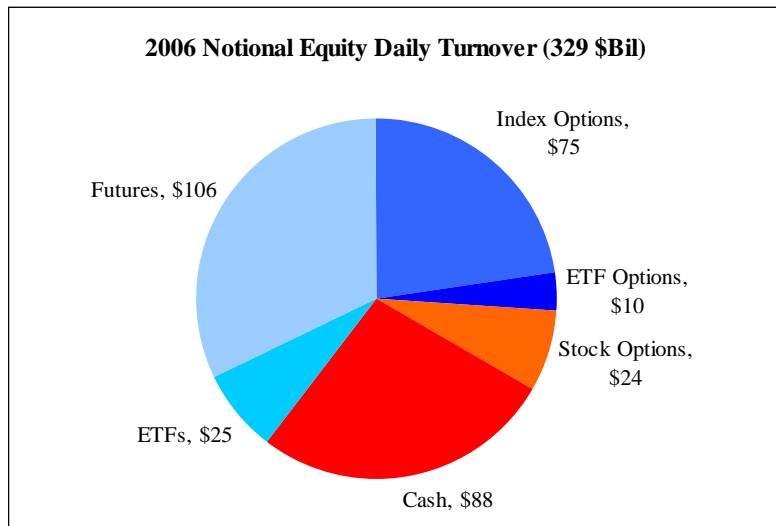
2008/2009 Crisis - Changes Brought by Market Volatility



- **Focus on Tail Risk:** Return vs. Volatility analysis is not sufficient when analyzing derivative strategies. Tail risk plays a critical role as leverage alters the balance between a strategy's return, volatility, and probability of catastrophic losses (Figure above left).

- **Shift in Use of Derivatives:** Crisis shifted focus away from single stock to Index trading (hedging, allocations). Listed derivatives gained market share at the expense of OTC products. Use of ETFs increased 250%, Futures 20%, while Cash and Single Stock Options volumes declined 50% and 20%, respectively (Figures below).

- **Inter-Relationship between Cash and Derivatives** will be the focus of the rest of this presentation.



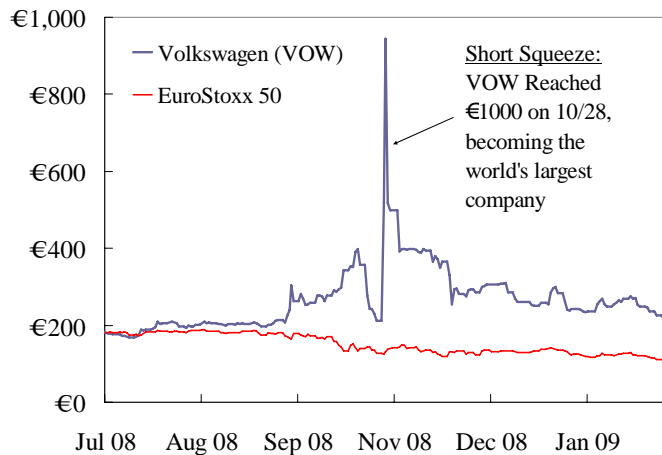
Source: J.P. Morgan Derivatives and Delta One Strategy.

Inter-Relationship between Cash Equities and Derivatives

- 1) Short Squeeze Impact Example (Europe: Euro Stoxx 50)
- 2) Exotics Delta Hedging Impact (Asia: Nikkei 225, Kospi 200)
- 3) Market Momentum: Impact of Gamma Hedging (US: S&P 500)
- 4) Market Reversion: Impact on Levered ETFs (US: S&P 500)

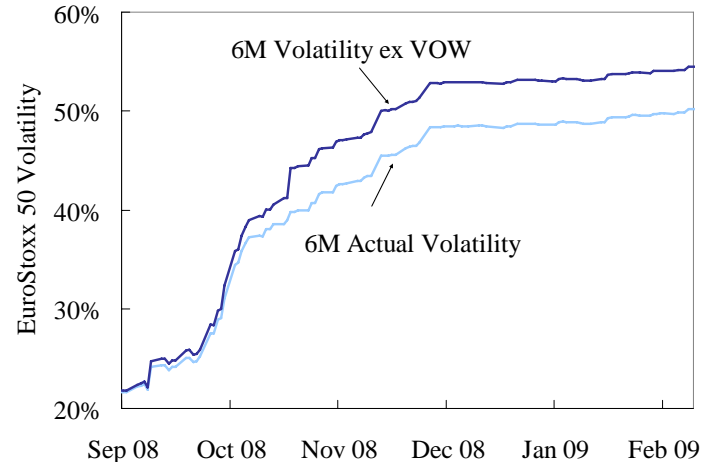
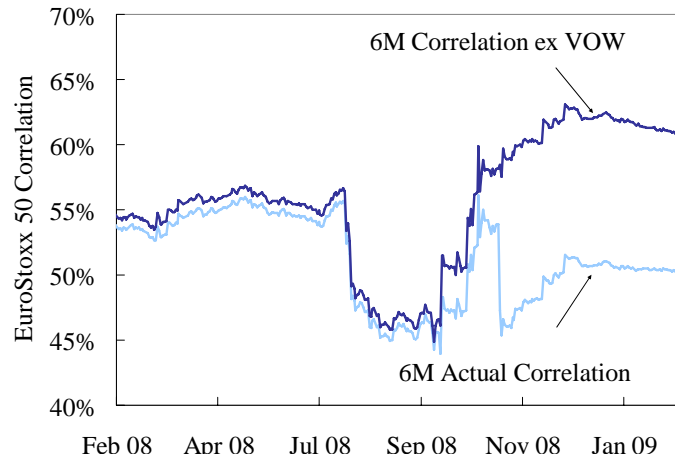
Short Squeeze Impact Example

- In early in 2008 investors increased short positions in Volkswagen (VOW) after an increase in the stock's price and on negative prospects for the industry. On 10/26 Porsche announced its intention to acquire 75% of VOW and disclosed a ~32% stake in 'cash-settled options.' As Lower Saxony held 20%, investors feared that options hedgers were holding up to ~32% and that there might be only ~5% of VOW shares in the market. This caused a dramatic short squeeze in the stock (Figure below left).



- A large and uncorrelated move in VOW on 10/28 significantly changed the properties of the EuroStoxx 50 and impacted settlement values for OTC derivative swaps tied to correlation and volatility of the Index (Figures below).

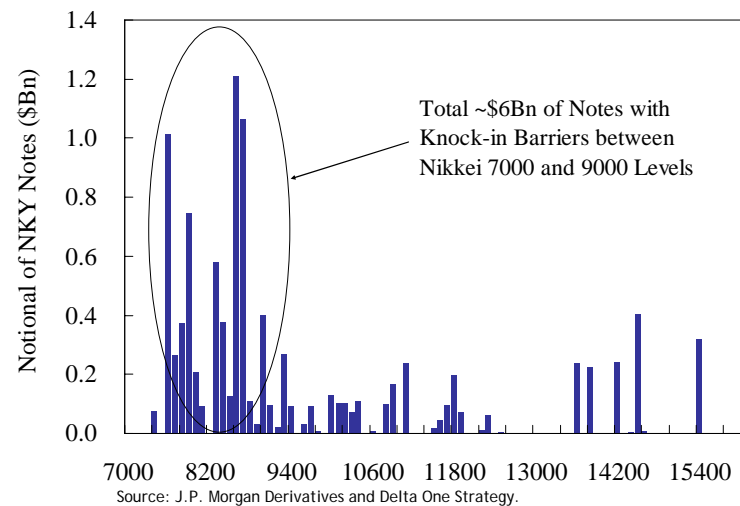
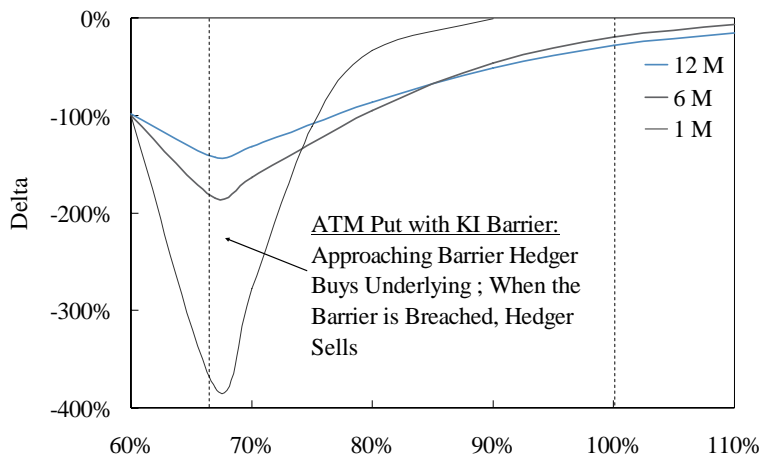
- Following the spike, index providers modified their weighting rules to avoid these types of distortions: DAX capped VOW weight to 10% (down from 27%), EuroStoxx and MSCI reduced free float (and VOW weight) by ~25%.



Source: J.P. Morgan Derivatives and Delta One Strategy.

Exotics Delta Hedging Impact

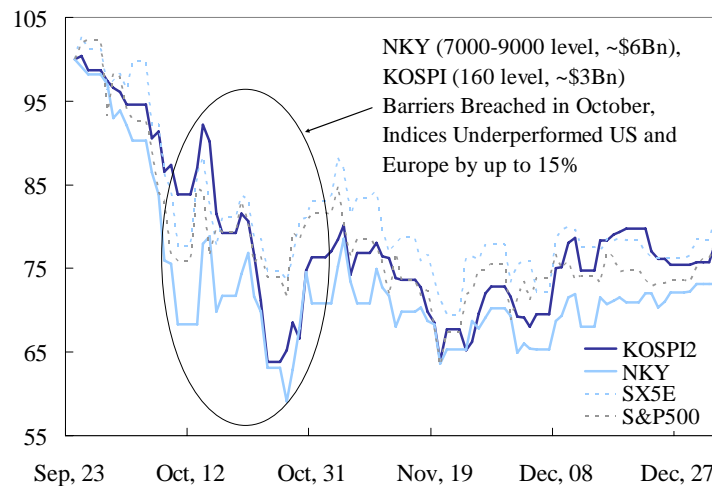
▪ The most popular retail structured products in Asia are 'Autocallable' notes linked to Kospi 2000 or Nikkei 225. These notes pay high coupons, but investors take equity downside if the index falls below a pre-determined level (investor is short a put with a knock-in barrier). Barriers are usually set at 50%-70% of the index level at issuance. The hedging of these knock-in puts requires that dealers buy the index as the price approaches the barrier level. If the index falls below the barrier, hedgers need to sell a significant amount of the index (Figure below left).



Source: J.P. Morgan Derivatives and Delta One Strategy.

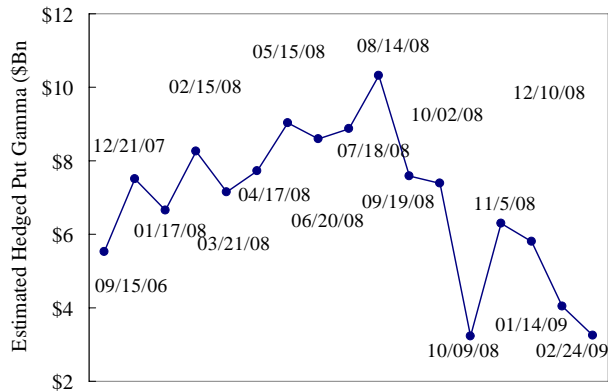
▪ Based on our estimates, in 3Q2008 there were ~\$6Bn of Nikkei-linked notes and ~\$3Bn linked to Kospi. Nikkei barriers were in the 7000-9000 range (Figure below left) and Kospi barriers ~160.

▪ With a drop in global equity prices in October, these barriers were breached which caused additional selling pressure on these indices. Over the same time period, Nikkei and Kospi underperformed the S&P 500 and the EuroStoxx 50 by up to 15% (Figure below right). Part of this underperformance can be attributed to the unwinding of structured product hedges.

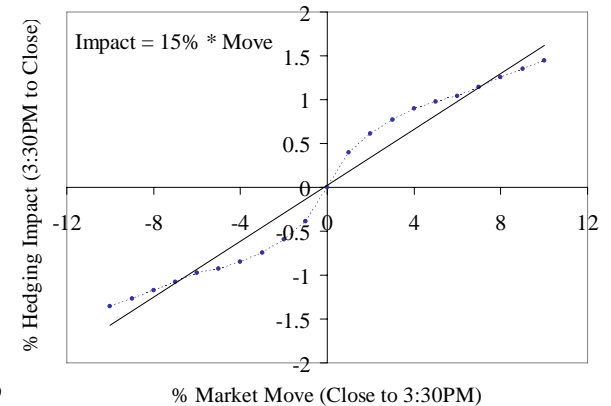
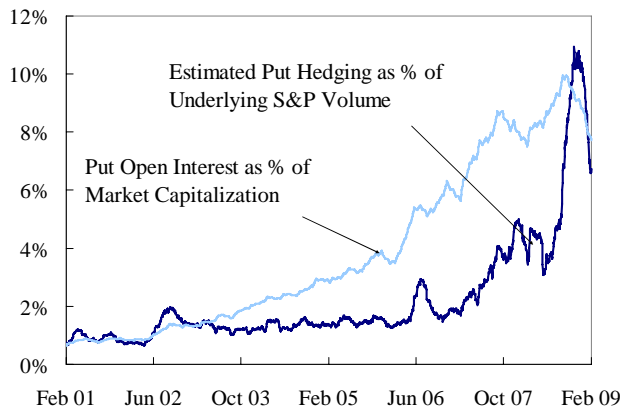


Market Momentum: Impact of Gamma Hedging

■ The amount of exposure controlled by S&P 500 options is currently at ~13% of the market capitalization. Most directional investors buy puts as a market hedge. We estimate that 40-50% of the total risk of put options is hedged by dealers. Being short puts, dealers are short a certain amount of “gamma risk.” This means they need to buy (sell) this amount of S&P 500 for every 1% increase (decrease) in the market level, usually at the end of each trading day. The hedging of short gamma exposure therefore causes intraday market momentum near the end of a trading day. The current amount of hedged gamma is shown in the Figure below at left. Compared to last year, gamma dropped from an average \$7Bn to an average \$3.5Bn for the first two months of 2009. However, this lower gamma is traded in a less liquid market and the average participation rate of gamma hedging trades in the overall S&P 500 volume is still high (Figure below center).



Source: J.P. Morgan Derivatives and Delta One Strategy.

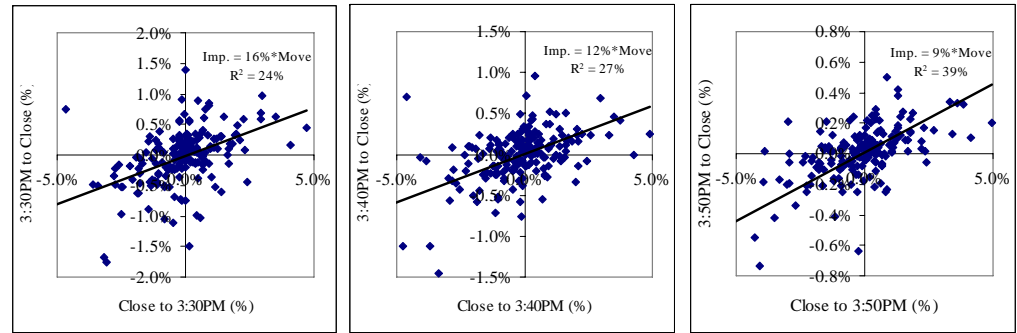


■ Gamma hedging flows will impact the market in the last 30 minutes of a trading day. Based on our market impact model for the S&P 500, we estimate that the market move (prior to 3:30PM) is amplified by 15% in the last 30 minutes as a result of gamma hedging flows (Figure above right).

■ In addition to the gamma of listed options, Variance swaps and levered ETF hedging also contribute to the net short gamma. Our estimate is that there was a net ~\$1.5Bn of variance short gamma in the first part of 2008. As the variance contribution declined (our current estimate is ~\$0.3Bn), the gamma from the hedging of levered ETFs increased to \$0.8Bn.

Market Momentum: Impact of Gamma Hedging

- The gamma hedging effect is confirmed by the analysis of intraday data. The figure at right shows the regression of market returns from the close to the 'hedging cutoff' (3:30, 3:40, and 3:50PM) for 2008, as well as the summary statistics over the past 4 years.
- As the hedging flows are proportional to the size of market moves, the effect is strong when the volatility is high (e.g., in 2008).
- A similar intraday momentum effect is observed in the EuroStoxx 50 index.

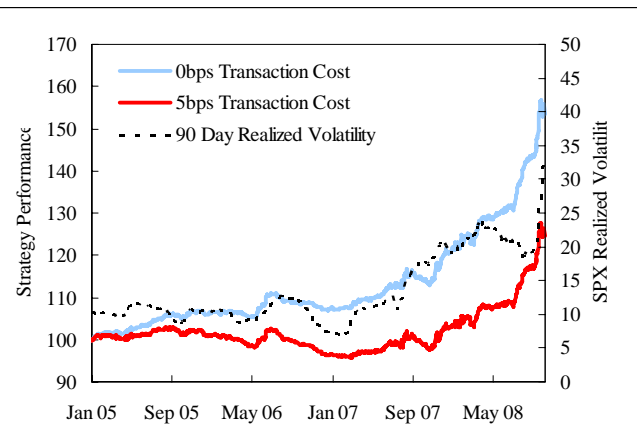


Year	Slope			Correlation			T-stat		
	3:30	3:40	3:50	3:30	3:40	3:50	3:30	3:40	3:50
2005	5%	6%	3%	16%	24%	21%	3	4	3
2006	1%	2%	1%	4%	8%	4%	1	1	1
2007	11%	7%	9%	29%	23%	44%	5	4	8
2008	16%	12%	9%	49%	52%	62%	8	8	11
All	8%	6%	5%	25%	24%	30%	6	6	8

Source: J.P. Morgan Derivatives and Delta One Strategy.

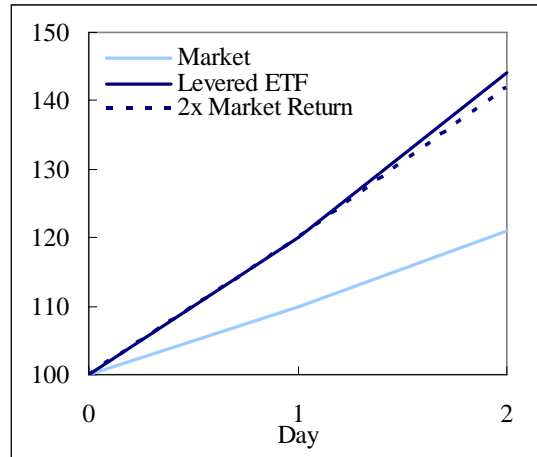
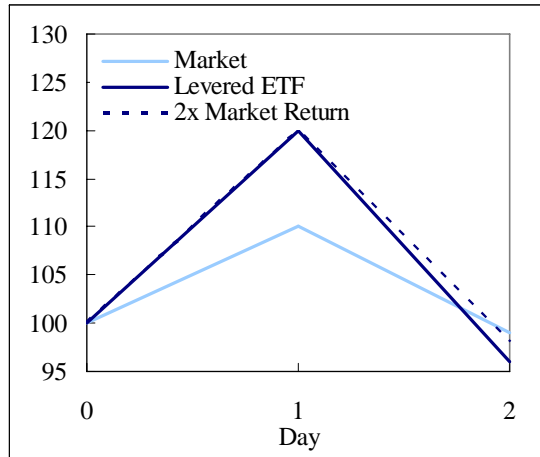
T-cost	Perf.	3:30PM	3:40PM	3:50PM
0bps	Ret.	50%	39%	25%
	Risk	7%	5%	3%
	Inf. Rat.	7.4	7.7	7.2
4bps	Ret.	42%	32%	18%
	Risk	7%	5%	3%
	Inf. Rat.	6.1	6.2	5.2
8bps	Ret.	34%	24%	12%
	Risk	7%	5%	4%
	Inf. Rat.	5.0	4.8	3.4
12bps	Ret.	26%	17%	6%
	Risk	7%	5%	4%
	Inf. Rat.	3.8	3.4	1.6
16bps	Ret.	19%	11%	0%
	Risk	7%	5%	4%
	Inf. Rat.	2.8	2.1	0.0

Source: J.P. Morgan Derivatives and Delta One Strategy.



- One can create a trading strategy based on predictable intraday momentum patterns. An investor would buy the market at 3:30 if it is up for the day (and sell it if it is down). Position is then closed out at 4:00PM.
- The strategy is positively correlated with market volatility.
- The performance for 2008 is shown in the table to the left for different levels of transaction cost. The chart shows performance from 2005.

Market Reversion: Impact on Levered ETFs



Source: J.P. Morgan Derivatives and Delta One Strategy.

- Levered ETFs (LEFTs) aim to provide levered long or short exposure to the daily returns of equity indices. There are currently over 100 LETFs with ~\$20bn of assets.
- While LETFs provide levered exposure to daily returns, it would be reasonable that a similar performance would hold over longer time periods. Many investors were surprised when LETFs underperformed over longer periods of time. For instance, when the double short FTSE China 25 ETF was down 56%, while the underlying index was down 34% over the same time period, etc.

- To understand the deviation of LETFs' performance from the levered returns of ETFs over longer time periods, we look at this divergence over a two-day period with consecutive 10% returns in two scenarios (Figure above). If the market reverts, the index will perform as 100-110-99, and a 2x-LETF as 100-120-96 hence "underperforming" by 2%. If the market trends, the index will perform as 100-110-121, and a 2x-LETF as 100-120-144 hence "outperforming" by 2%. The 2-day divergence is:

$$2 - \text{Day Divergence: } (p^2 - p) \cdot r_1 \cdot r_2$$

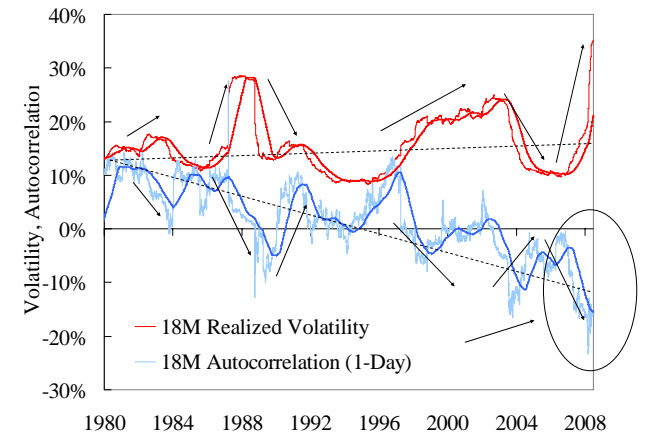
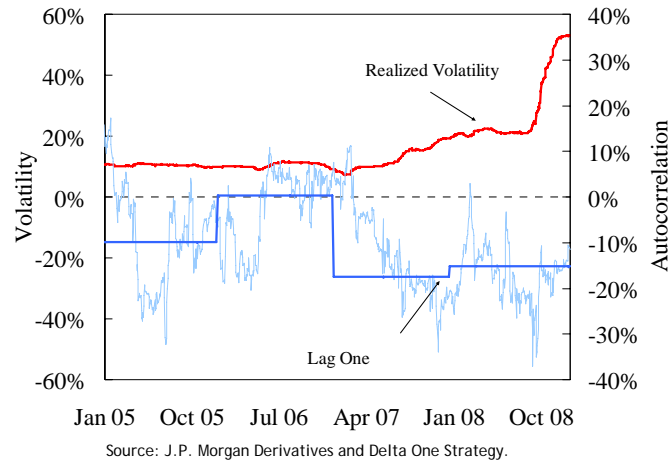
- If market returns are random (equally likely to go up or down), on average LETFs should perform in line with levered returns of ETFs over longer periods of time. So why did most LETFs perform poorly over the past year?
- The significant underperformance of LETFs over the past year is suggesting that the market was highly mean reverting over the past year. More generally, the divergence of LETFs' returns will be the result of the balance between trending (cumulative return) and reversion (volatility):

$$\text{Divergence: } \frac{1}{2} \cdot (p^2 - p) \cdot (r^2 - \sigma^2 \cdot T)$$

$$E[r_T^2] - \sigma_t^2 = 2 \cdot \sum_{k=1}^t \frac{t-k}{t} \rho_k \sigma_k^2$$

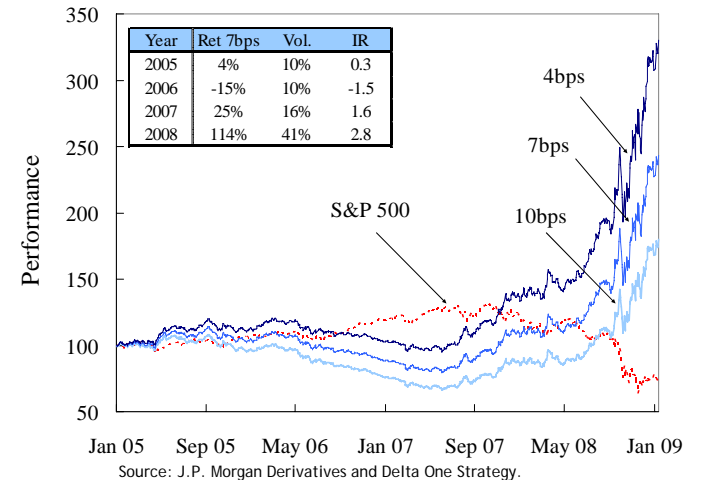
Market Reversion: Impact on Levered ETFs

■ We now focus on mean reversion in the market as measured by correlations between S&P 500 lagged returns. Over the past 2 years these correlations were negative pointing to a strong mean reversion of day-to-day returns. In addition, the market tends to be more mean reverting when volatility is high (Figures at right).



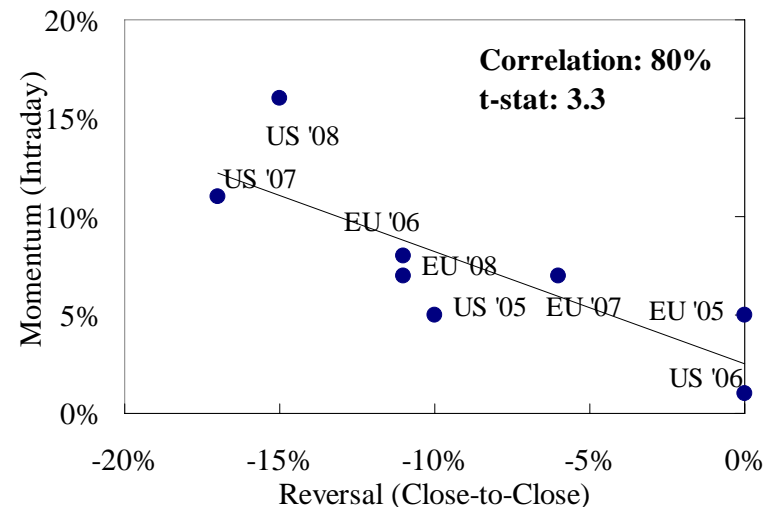
■ In addition to the relationship between volatility and reversion, we see that the amount of reversion steadily increased over the past 30 years. We attribute this to the increased use of leverage, dynamical hedging programs, and derivatives that create overall short gamma exposure. The reversion of the temporary impact of gamma hedging flows largely contributes to daily reversion patterns. In addition to structural reasons related to leverage, we believe there are other technical and behavioral reasons for the reversion effect.

■ One can create a trading strategy based on predictable reversion patterns. An investor would buy the market on the close if it was down for the day, and sell it if it was up for the day. The position is closed at the end of the following day. This simple S&P 500 trading strategy would have yielded 114% return at 41% volatility during the 2008. The performance over the past 4 years is shown in the figure at right for different levels of transaction costs. A similar daily reversion effect is observed in the EuroStoxx 50.



Momentum and Reversion Are Related

- Finally, we investigate the link between the intraday momentum effect that results from gamma hedging, and the reversion effect that caused the underperformance of LETFs. We already argued that the effects are related as in a volatile environment the gamma hedging intraday impact dissipates over the following day forming a basis for daily market reversion. At the same time volatility further increases the reversion effect as observed over the past 30 years.
- In order to do a statistical comparison, we monitored the strength of the intraday momentum and daily reversion patterns in the US (S&P 500) and in Europe (EuroStoxx50) in each of the past 4 years. Several observations directly link the market momentum and reversion effects. In 2006 both the momentum and reversion effects were absent in the US market. Similarly, in 2005 both effects were weak in Europe. 2007 and 2008 were the years where both effects were the strongest in the US (similarly in 2006 and 2008, both effects were strong in Europe).
- Regressing the coefficients of momentum and reversion for the US and Europe over the past 4 years, we find that the two effects are related with a high statistical significance.



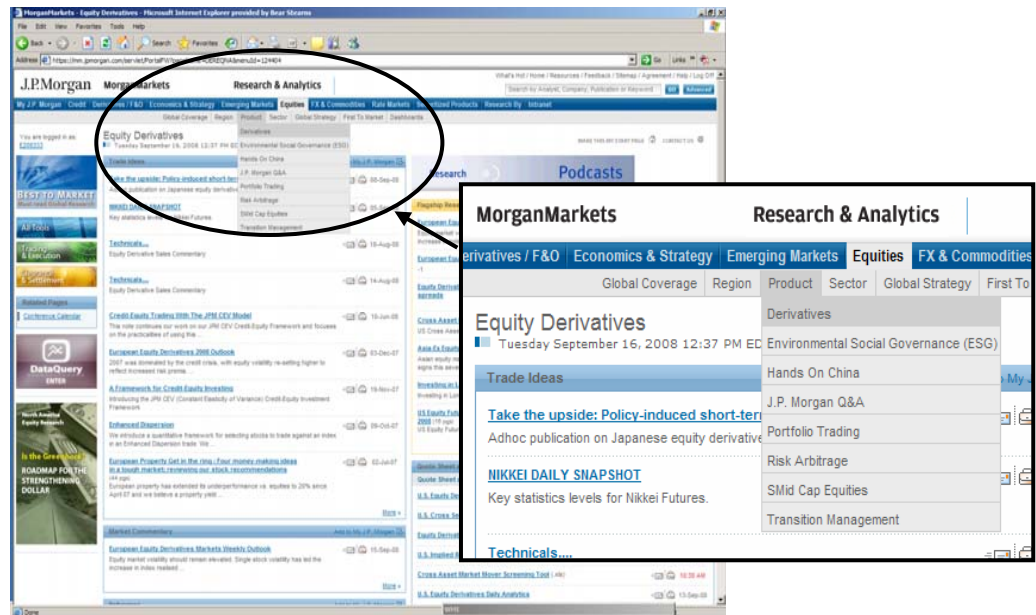
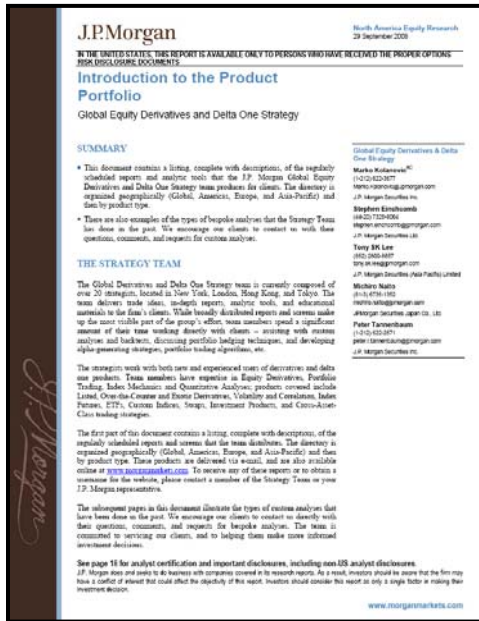
Year	SPX			SX5E		
	Rev.	Mom.	Mkt. Vol.	Rev.	Mom.	Mkt. Vol.
2005	-10%	5%	10%	0%	5%	11%
2006	0%	1%	10%	-11%	8%	15%
2007	-17%	11%	15%	-6%	7%	16%
2008	-15%	16%	41%	-11%	7%	40%

Source: J.P. Morgan Derivatives and Delta One Strategy.

Appendix: JPM Strategy Team Snapshot

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- ~20 analysts in New York, London, Hong Kong, Tokyo, and Mumbai
- ~70 regular strategy publications: reports, screens, product notes, and commentaries
- Provides customized analyses and bespoke research for clients and trading desks
- Available at www.morganmarkets.com (Derivatives, Delta One - Portfolio Trading)



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