Don’t forget 1987 – portfolio insurance, trend following and QE

19 July 2015

I started studying economics in September 1987. One month later the US stock market dropped 22% in a day. 28 years later and I’m still studying economics, and stock markets are still crashing.

Reflecting on the circumstances around 1987 offers insights into today’s markets and the recent performance of managed futures. The key point of this note is to observe that trend following has much in common with portfolio insurance and in general dynamic hedging, and as such it is easy to understand with hindsight that the costs of insurance were not worth paying for many investors because equity and fixed income markets inexorably rose in recent years. But to add insult to injury the price dynamics that QE and related policies created actually *raised* the cost of implementing such strategies as well.

The interplay between derivatives and investor behaviour in the 80s

To understand the current popularity of algo driven trading strategies it’s helpful to look back to the 70s and 80s. This was a fascinating period when there were mutually reinforcing developments in derivatives market that led to fundamental changes both in the underlying markets and in investor behaviour.

The modern options market grew rapidly with the product standardization that followed the launch of the Chicago Board Options Exchange in 1973. The subsequent widespread adoption of Black-Scholes and associated pricing and risk formulas arguably also led to a standardization of behaviour, aided by the ‘mobile’ technology of the time – hand held calculators.

As hedging practices became better understood people realised that similar pay-offs to options could – in theory – be created by dynamic trading of the underlying futures. This led to the creation of portfolio insurance strategies. There were several variants but the basic idea was extremely simple. If you are naturally long equities, and want to hedge your exposure, then instead of buying a put option,

you could employ (or pay someone to employ) a dynamic trading strategy that would replicate the pay-off to an option without actually trading the option itself. Exchanges also had restrictions limiting the size of options positions so large accounts were forced to look at portfolio insurance.

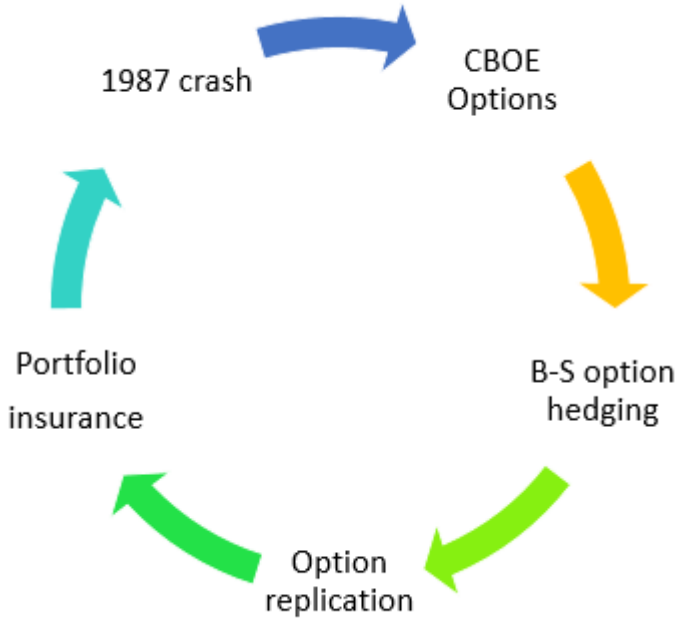

Chart 1. The development of derivative markets in the 70s-80s. The CBOE launched in 1973, Black-Scholes showed how to hedge options. This led to the synthesis of options with dynamic strategies. These strategies were sold as insurance. Then 1987 happened… and the options market was forever changed as the smirk arrived.

On the 19th October the S&P market fell 22%. Even today there is not consensus on the precise cause and relative importance of all the factors involved, but it is fair to say that most of those with a view think that portfolio insurance strategies at least contributed to the severity of the fall, and many would say it was the catalyst.

A simple story can be told. The market had been very strong and risen nearly 50% during the first half of the year but was weakening throughout the summer. Fears were growing that the previous strength may have been a bubble. The macroeconomic backdrop was also weakening. The great

storm in the UK resulted in the UK stock market being closed on the Friday before Black Monday, and so with markets generally weak worldwide, by the time markets opened on the Monday there was a backlog of sell-orders. It is thought this generated more selling as portfolio insurance algorithms and index arbitrage hedging programs were triggered. It seems there was little risk-capital prepared to balance the sell-orders: volatility increased to unprecedented levels, gaps occurs in both the derivative and cash markets and transaction costs increased.

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There was much discussion subsequently as to the precise role of portfolio insurance, but what we can observe is that the use of explicit portfolio insurance fell dramatically and the Federal Reserve and other regulators responded to events with policies and words designed to soothe markets, and with practical new mechanisms like circuit-breakers. It had become apparent that faster information transmission, the use of algorithms and related increases in trading speed had fundamentally changed the nature of markets.

You could argue this was the beginning of a perception that policy makers would step in in times of market volatility – and to some this was seen as a first and regrettable step towards the introduction of moral hazard into markets. It became known as the 'Greenspan put'.

Another thing that occurred after the crash was that for the first time equity option markets began pricing in a risk of large falls, as evidenced in the emergence of a smirk in the option pricing smile. Prior to 1987 such skews had been observed in currency options, but not in equities.

It is interesting to think why there wasn't a smirk in option prices before. It's not that people didn't fear the possibility of falls. The popularity of the portfolio insurance industry clearly demonstrates some did. Perhaps investors didn't think prices could fall as much as they consequently did. But maybe also the lack of a smirk reflected misplaced confidence by option sellers in their ability to hedge their positions. Much of the Black-Scholes world relies on assumptions of a continuous price process, and the ability to continuously hedge. If you relax those assumption and admit the possibility of sudden discontinuities in prices, and in the functioning of markets (volatility of liquidity) then surely option sellers would demand a substantial risk-premium, particularly for option strikes that, if in play, would be correlated with wider market stress. So one argument is that the smirk represents not just an implied probability distribution suggesting large falls are more likely than large rises, but also it reflects a risk premium (or fudge-factor) adjusting for the shortcomings of the option pricing model. But whatever the precise explanation the option smirk appeared and has been with us ever since.

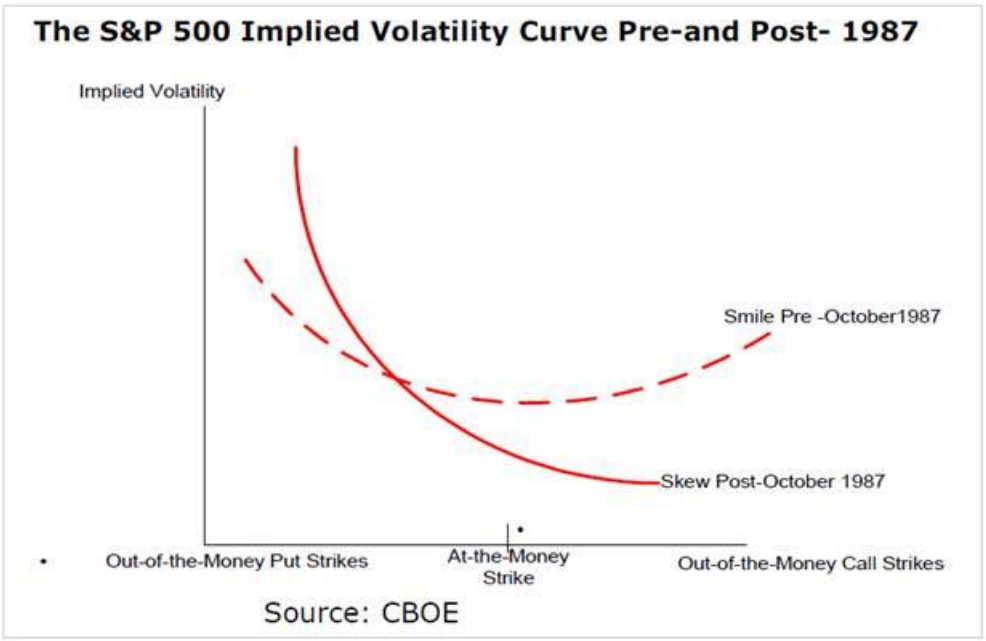

Chart 2. The option smile pre and post 1987

Insurance policies are costly – but market volatility alone doesn't tell you much about the cost

Portfolio insurance is designed to do what it says on the tin. Provide insurance. Insurance of course comes with a cost. The cost of portfolio insurance (or more generally dynamic trading strategies) has two parts. First there are implementation costs, and the more continuous the trading the greater these costs might be expected to be because costs get generated by turnover: spreads; commissions and market impact. Second, there is the trading P&L cost. During times in which the markets do not continue falling the strategy may get whip-sawed.

As the market falls a portfolio insurer would sell index futures, and keep selling more as the market falls further but if the market rallies they would make losses on those short positions, albeit trying to reduce their short positions at the same time. The strategy is one of positive feedback. So if prices stay range-bound you are likely to face both trading losses and implementation costs. And importantly these costs are not easily related to market volatility, what matters is not the outright level of market volatility per se but the dynamics of price changes. The worst type of market would be one in which prices fall gradually so large short positions build up, but then sudden reversals occur. Volatility as commonly referred to in markets – a single number measuring the standard deviation of price changes – is not a sufficient statistic to describe this type of price dynamic.

Option markets help price insurance and increase information, dynamic strategies do not

As already discussed multiple volatilities exist to describe pricing and risk within the options market. There isn't one volatility that we can talk about, there is a smirk and this smirk reflects information about price dynamics that cannot be captured by a single volatility alone. Nonetheless the multiplicity of implied volatilities that options markets give us does convey useful information.

In fact just prior to the 1987 crash Sandy Grossman published an article explicitly making the point that it would be a shame if the options market got replaced by dynamic trading strategies (Grossman, 1987). His argument was that the option market provides *securities* which are priced and thus provide information that enables market-makers and other liquidity providers to plan ahead. If they can

forecast future volatility they can commit risk capital which should help provide liquidity in the future. The replacement of option securities by trading *strategies* which are not priced in the same way, does not easily reveal the markets beliefs about, and sensitivities to future volatility. He suggested that this issue could be alleviated if there was a means to observe how much portfolio insurance there actually was going on.

Trend following, volatility targeting and insurance

Explicit portfolio insurance fell out of favour after 1987, and it probably felt socially unacceptable to be automatically selling as prices fell, and buying as prices rose with no regard to any sense of fair value. But over the next few years another dynamic strategy called trend-following began increasing in popularity and it did exactly that. The core idea within trend following is the same as that in portfolio insurance. In practical terms at an individual market level trend following tries to construct synthetic calls and puts, therefore allowing the strategy to benefit in both rising and falling markets. Beside this agnosticism to market direction, the main difference between portfolio insurance and trend following is that trend followers tend to diversify across many different markets and asset classes. They don't target equity exposure directly. By diversifying across markets trend followers hope to be able to make many simultaneous bets and thus help smooth out returns. The chart below shows the rapid growth in AUM of CTAs (commodity-trading-advisors) according to one well respected index. It is reasonable to assume that much of the AUM here would be linked to positive feedback strategies following in essence almost identical algorithms to the portfolio insurers.

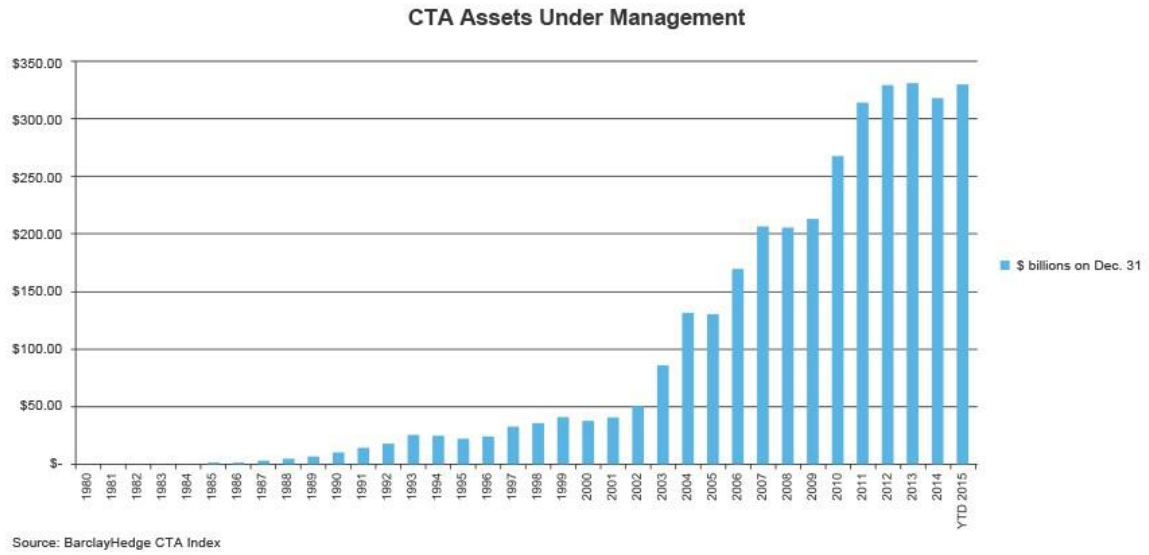

Chart 3. AUM in CTAs, much of which is likely to be following positive feedback strategies

What is interesting is that many trend followers do not appear to sell themselves as providing insurance per se. They tend to focus on anticipated long-term capital appreciation and the long-term lack of correlation (as opposed to outright hedge) between their return streams and more traditional investments such as long-only equity products. That said one of the largest and longest standing trend followers, Man AHL recently published some work discussing the use of trend following strategies to help improve the costs associated with fixed-weight portfolio rebalancing (Granger et al 2014). The mechanism via which their proposal works is similar to that behind dynamic hedging.

Another technique growing in popularity is volatility targeting. The idea here is that an investor tries to maintain a stable level of risk over time by reducing or increasing their notional exposures as their forecasts of future volatility change. This technique has long been used in the managed futures industry, but also underpins other more passive, and often long-only strategies such as risk parity. It also generates a feedback process, and in equity markets the process is likely to be positive feedback. This is because in equity markets price falls tend to be associated with rising volatility, and vice versa. This means that a volatility targeter will be selling as prices fall (as volatility rises they need to hold less notional exposure) and buying as prices rise.

A revisionist view of trend following and technical analysis

Most academics from economics and finance have viewed dynamic trading strategies like trend following with healthy scepticism, while others not weighed down by notions of efficient markets and constantly optimizing rational agents have been more open. The conventional wisdom is that most of the large CTAs and quant funds were started by physicists who looked beyond (or frankly ignored) the economist's scepticism and just got on with it. In more recent years the economics profession has opened up in ways that make the study of what is essentially technical analysis much more acceptable.

There is a misunderstanding here. Few, if no economists ever said that risk premia don't exist, and I suspect that much of the historical profitability of managed futures has come from gathering uncorrelated risk premia over time, for example earning term spreads in fixed income (carry), and roll-down in commodity markets. This is consistent with the fact that long-only diversified portfolios such as risk-parity ones also have good historical track records.

But recent years has seen a quiet emergence of another means of accommodation where maybe both physicists and economists can say they were both right. In a recent paper Richard Martin and David Zou (2012) emphasised the role that dynamic trading strategies have in transforming market returns into trading returns. The key insight here is that the trading returns the investor receives can have a positively skewed distribution while the underlying market return distribution may have a different shape. There may be no improvement in average return. This result has been around a while but not I think made so explicitly, although work by Lo, Kaminksi and Bouchaud and others is in this vein. What this implies is that there may be benefits to trend following (and other commonplace dynamic trading strategies such as the use of stop-losses) that are beyond what consideration of the pure market timing aspects of them might reveal. Specifically, if investors value positive skews above negative skews then they may be willing to pay a price to avoid the latter. Economists do not get off the hook completely. In refuting technical analysis and practices like stop-losses over the years they almost exclusively focused on the first and second moment properties of returns i.e. how much profit and volatility such strategies generate compared to benchmark passive approaches like buy-and-hold.

The costs of trend following and difficulties of dynamic hedging

So looking at trend following as just another dynamic trading strategy, and thinking about the link to insurance that the earlier portfolio insurance industry offers, gives some insights into the costs and expectations around trend following. Trend following as a whole is widely thought to have struggled in the years 2011-2013, having had an outstanding year in 2008. Some investors may have felt perplexed and disappointed that despite incredibly strong trends in equity markets and fixed income, managed futures didn't seem to do very well. An often cited reason (excuse) is that there was an increase in correlation across markets. It is certainly true that correlations did rise, as has been well documented, but in general a rise in correlations would – ceteris paribus – lower the performance (as diversification benefits reduce), but not destroy it.

What is perhaps more plausible is that many dynamic trading strategies ended up facing high costs in terms of both implementation and P&L in trying to provide an insurance type pay-off structure. In the US equity market for example there was a remarkably strong trend during which there were several pull-backs, every one of which proved with hindsight, to be short-lived. This was exactly the type of price dynamic that would prove most damaging to a positive feedback strategy. As prices fell a dynamic hedging strategy would start reducing a long position and getting short, but then at some point there would be a sharp reversal and rally. The more actively the strategy sought insurance (in practical terms the quicker it reacted to price changes, or in portfolio insurance terms the less tolerance it had for losses) the more costly this type of strategy would have been.

And in other markets trend following may have suffered for exactly the same reasons that it has been argued dynamic hedging breaks down. This is because dynamic hedging, and associated strategies like portfolio insurance, rely on continuity of prices and liquidity. This works fine in a Black-Scholes textbook type world, but it regularly fails in the real world. As vociferously argued by Haug and Taleb (2011), occasional jumps and discontinuities in prices can undo months of perfect dynamic hedging.

Anecdotally, it is often heard that foreign exchange markets became impossible to trade profitably (several well known FX speculators closed down during 2012-2013) and some managers blamed policy makers for inducing jumps and reversals. If trend following is in essence a form of dynamic

hedging then you would expect it to suffer from the exact same problems that dynamic hedging faces, problems that have been well understood for years.

The limitations of volatility

Much confusion has been generated over the years by the natural desire by investors (and often managers) to try and describe strategies, or trades, as long or short volatility. I suspect the problem here is that we talk about volatility in quite a loose sense, often meaning uncertainty, stress, chaos. But when we measure it we tend to focus on very precise narrow measures like the standard deviation of daily price changes. As the multiplicity of volatilities in option pricing demonstrates, as soon as you move away from a very simple Brownian motion underlying price process, low or high measures of "volatility" can be consistent with dramatically different price dynamics which would have associated dramatically different effects on trades or dynamic strategies. To talk of trend following, or any other dynamic strategy as being "long volatility" is fairly pointless.

State provision of insurance

I would suggest that what caused market dynamics to change was the provision of insurance by the state. After 2008 central banks and governments the world over took unprecedented steps to reassure markets that they would insure the market from further crises. The 'Greenspan put' which came about after the 1987 crash paled into insignificance compared to the attempts to provide liquidity and underpin the financial infrastructure following 2008. QE was one policy among many that was explicitly designed to affect asset prices. Volatilities generally fell meaning investor leverage needed to rise in order to target the same level of dollar risk, but also costs of trading rose because commissions and spreads are fixed in dollar terms and so become a larger proportion of the overall P&L as volatility falls.

And by and large central banks were successful in providing a floor under many asset prices and falls in risky assets were quickly followed by falls in interest rates that helped prices recover – the so called risk-on risk-off dynamic. With hindsight we can see that the insurance costs intrinsic to dynamic strategies like trend following were not worth paying for many investors because equity and fixed

income markets inexorably rose. But to add insult to injury the price dynamics that QE and related policies created actually raised the cost of implementing such strategies as well.

Other implications of recent asset price developments

While dynamic insurance type strategies may have suffered in recent years, so did more explicit insurance strategies. Anyone taking out insurance by a process of buying put options would have paid a very hefty price over the last few years with no reward.

Some simple passive strategies benefited massively from QE. Risk parity for example was perfectly placed to do well. The idea there is to balance risk exposures, as opposed to notional exposures, sometimes in just equity and fixed income markets. The price dynamics created over the past few years were perfect for this approach. Both equity and fixed income markets steadily rose, but importantly the hedging offered from each market to the other was beneficial. Every time stocks fell fixed income rallied, and both drifted upwards over time.

Some shorter term dynamic strategies may have managed to exploit the short term buy-on-dips type dynamic that developed across many markets. Strategies based on some sort of adaption and learning techniques may have quickly discovered these patterns. Back-tests of such adaptive strategies may look very good over the past few years as they fitted to this regime.

If this story is right….here are two questions

This description of dynamic trading strategies, linking trend following and the concept of insurance is surely not the only story in town but I quite like it because it provides bridges between several areas of finance and economics, and several different aspects of recent history. Drawing on this way of thinking suggests at least two questions.

Firstly, if the state provision of insurance is removed, or significantly reduced, could this have further reaching effects than just an unwinding of the effects so far observed on asset prices? One thought might be that with the increase in automated dynamic trading techniques like volatility targeting and trend-following, is there a risk that algo driven selling causes a 1987 style crash again? To put it

another way, has the provision of (and expectation of) state insurance been the only thing stopping a 1987 style crash occurring again since 2008?

Second, has the state provision of insurance altered the supply of private-sector liquidity via some sort of crowding out effect? If investors are seeking insurance via alternative investment products as opposed to outright option purchasing, are we in a similar situation to the one Sandy Grossman identified in 1987 where the market as whole cannot easily get a reading on future price volatility, and therefore the ability to allocate capital to liquidity provision has been impaired?

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