Protection Strategies:

Analysis of Their Impacts on Market Stability

Continued market volatility has resulted in ongoing discussion and investigation of insulating investor portfolios from market risk. The practice of manipulating portfolio risk was revolutionised in the 1970's following the pioneering work of Black and Scholes with respect to option pricing theory and the subsequent implementation of their theories in the form of portfolio insurance by Leland and Rubenstein.

While theoretically elegant and initially hugely successful, portfolio insurance was in practice viewed as something of a failure, with it being seen as responsible for the 1987 market crash. Despite this, portfolio insurance never went away and it has in fact continued to grow in popularity (under a variety of guises) since 1987.

In recent times, as markets have gone through periods of increased volatility, most notably during the Global Financial Crisis (GFC) in 2008, debate has resurfaced about the value of portfolio insurance and with it, the potential impact on the stability of the financial system, commonly referred to as "Systemic Risk". This article reviews some of the common arguments for and against these strategies.

Introduction to protection strategies

Investors and investment managers have implemented numerous strategies to protect their portfolios from market risk in the past three decades, including portfolio insurance, protected margin loans, option budgets, and variable annuities. At their core, each of these strategies can be deconstructed into one of two broad protection techniques – option based portfolio insurance (OBPI) and constant proportion portfolio insurance (CPPI).

OBPI, based on Black-Scholes option pricing theory accomplishes protection through either the purchase or dynamic replication of an option. Put-call parity means OBPI can be implemented using either put or call options depending on the structure of the protection and with consideration given to any market anomalies, such as the presence of franking credits that may favour one approach over another.

The development of CPPI was borne out of the search for a time-invariant protection strategy that could address the early constraints of OBPI approaches. In particular, early OBPI approaches required a fixed term for the investment.

As an alternative, CPPI relied on dynamically rebalancing the asset allocation of the portfolio between growth assets (the underlying) and a 'risk free' portfolio according to the following formula:

$$\textit{Growth Assets} = \textit{Multiplier} \times (\textit{Total Assets} - \textit{Protection Floor}).$$

This approach results in a diminishing allocation to the underlying (and an increased allocation to the risk free asset) as the overall account value falls. In theory, under this strategy, the asset value can never fall below the floor – which is set to ensure that funds invested in the risk free asset will accumulate back to the protected

amount over a certain time horizon. In reality, discrete time market movements and rebalancing thresholds do make it possible for the account value to fall below the floor. To combat this potential risk, CPPI providers can offer an additional guarantee over and above the mandated strategy.

Analysis

The core argument for protection strategies causing systemic risk is that these are buy-high / sell-low strategies. Falling markets lead to increased selling, accelerating the fall in the market and resulting in a negative 'feedback loop' that serves to put further downward pressure on market prices.

To analyse this assertion we must begin by understanding the drivers of any trading activities for the dynamic strategies outlined within this article. Static OTC option-based protection does not involve rebalancing as markets move, although there will arguably be some dynamic replication by the OTC option provider. Regardless, our analysis focuses on the dynamic protection strategies as these will potentially have the most severe systemic impacts.

Under dynamic protection strategies, a sell trade occurs when markets fall in response to the increased likelihood that the account value will be lower than the protection target at the end of the protection term.

The extent to which this rebalancing occurs will depend on the sensitivity of the protection strategy to the downward market movement – often referred to as delta (Δ). It is important to note that delta is not static and changes as markets move (referred to as gamma Γ). Comparing these metrics under different strategies helps to provide insight into the dynamic nature of trading that occurs under various scenarios.

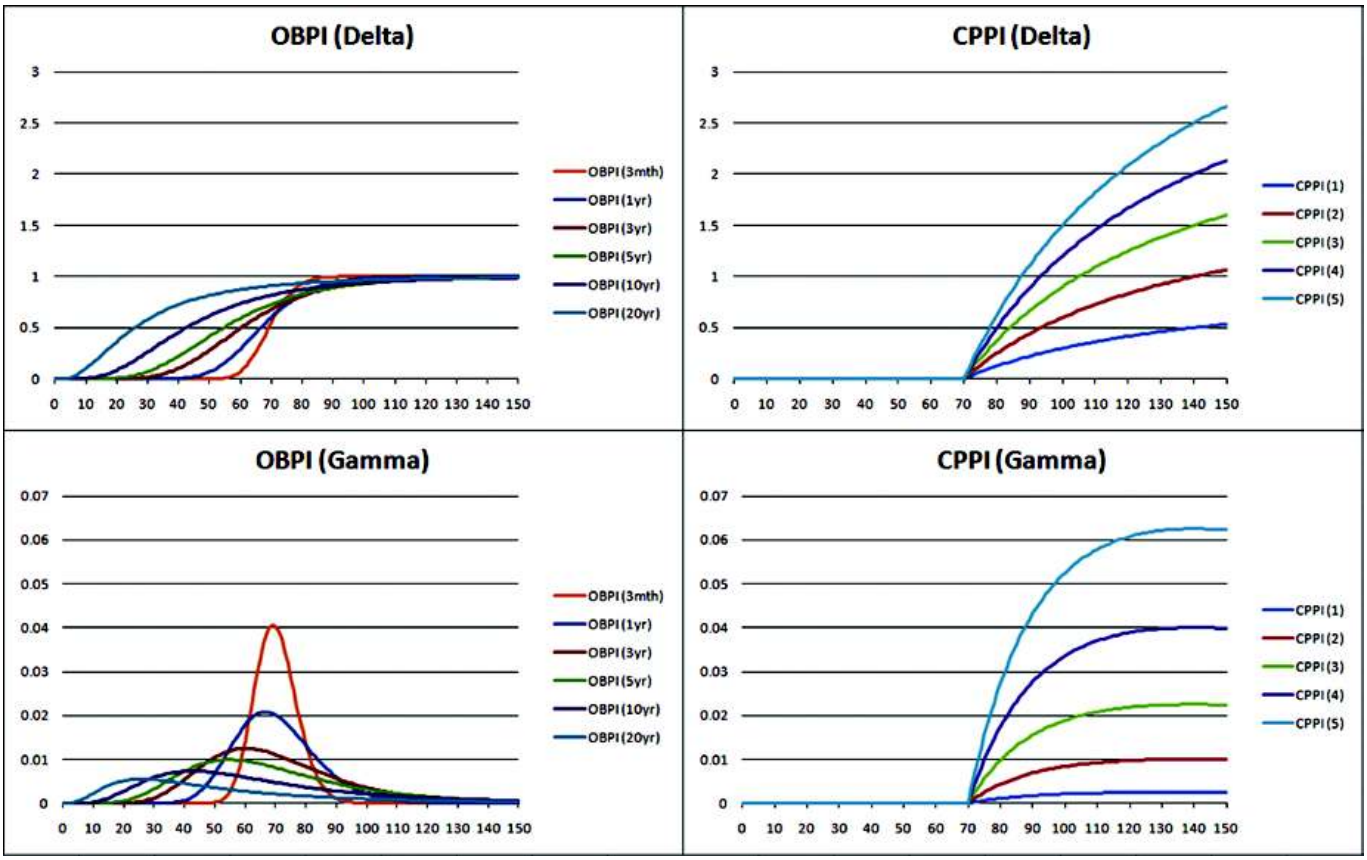
For the purpose of this article, we have compared a number of OBPI and CPPI strategies utilising different underlying parameters. For OBPI, the key parameters are the term to maturity and the protection level (or strike price). For CPPI, the key parameters are the multiplier and the protection floor (as described in the previous formula). The floor for CPPI is analogous to the protection level under OBPI so we have considered a common fixed protection level / floor of 70% of the initial investment. Various OBPI tenors ranging from 3 months to 20 years, and CPPI multipliers ranging from 1 to 5 have been assessed.

Figure 1 shows the Δ and Γ profiles of the two strategies for each of these variations. The horizontal axis illustrates the account values from the perspective of the protection provider assuming initial account values of 100.

Analysing these charts provides some useful insight with respect to the various strategies:

- OBPI consists of a long exposure in the underlying assets together with a put. As such the Δ of an OBPI strategy always lies between 0 and 1. Consequently, leverage is not a fundamental feature of the strategy.

Figure 1: OBPI Delta Profile



- By contrast the Δ and hence the leverage of a CPPI strategy increases significantly beyond the floor value as equity markets increase. This is a function of the multiplier which effectively drives the extent to which leverage is a feature of the strategy.
- Longer term OBPI strategies will result in lower levels of forced trading (Γ), or rebalancing in most cases as the expected risk free return insulates the strategy against short term market fluctuations. As the OBPI strategy approaches maturity selling pressure will increase for accounts that are at-the-money (i.e. the current account value is close to the protection target).

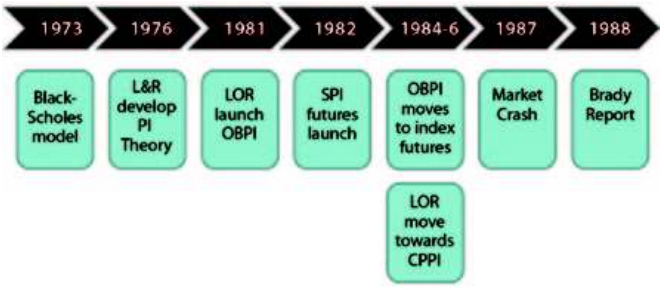
To put these charts into some perspective, we have also assessed the impact of an extreme market movement on both a 20 year OBPI strategy as well as a CPPI strategy with a multiplier of 5 (CPPI[5]). In this example, the market falls instantaneously by 10% with $10 billion invested in each strategy.

Under the CPPI[5] strategy, the investment manager will be forced to sell around 50% the equity exposure (since $\Gamma \approx 5\%$), which equates to $7.5 billion. On the other hand, under the 20 year OBPI strategy, the rebalancing is approximately $7 million – less than 0.1% of the impact of the CPPI strategy. This is an extreme example, but it illustrates the importance of leverage when analysing systemic risk.

Lessons from history

Any study of market impacts of protection strategies would be incomplete without considerations of the most famous market crash (at least until the GFC) which took place on the 19th October 1987 – commonly referred to as "Black Monday". It is best remembered for the 20% intra-day market decline and the dislocation that occurred between equity and futures markets. Before analysing these events, it is important to add some historical context for any readers who may not be familiar with the detail behind this dramatic event. Figure 2 is a simplified timeline of some of the key events relevant to 'Black Monday'.

Figure 2: Events Leading Up To 1987 Crash



Some important points to note about the historical context include:

- Option pricing theory and the concepts of replicating portfolios were revolutionary at the time
- The index futures market was in its infancy.
- Computers were rare and lacked anything approaching the processing power we see today.
- At the time of the crash Leland, O'Brien and Rubinstein (LOR) had migrated most of their portfolio insurance accounts to CPPI based strategies.

Almost universally the blame for both the crash and near market failure was placed squarely on the shoulders of portfolio insurance. The Brady report, which was delivered to the US government in January 1988, is damning of the role played by portfolio insurers in the 1987 crash. Some of the key findings included:

- Portfolio insurance accounted for approximately 15% – 30% of the futures volume traded intra-day, peaking at 80% at times – that is, protection strategies contributed significantly to the selling.
- There was a massive dislocation between the spot and the futures markets caused by excess selling pressure in the futures market and an inability of arbitrageurs to fill the void.

The report goes on to also note:

- The crash came on the back of string of negative economic data (essentially fundamentals initiated the crash).
- None of the intervention actions, taken by the regulatory authorities including a number of trading halts, were successful in stemming the fall. The fall in the market was eventually stopped by the market itself as listed companies recognised the deep discount of their own stock versus fundamentals and initiated share buy-backs restoring market confidence.

Whilst noting that the commonly held belief is that portfolio insurance was a primary driver of the severity of market crash it is worth noting that this view was not unanimous. A number of alternative opinions exist. In particular, Leland and Rubinstein (L&R) argued the following points:

- Markets worldwide experienced falls of a similar magnitude, while portfolio insurance was only implemented in the US.
- If the market knew the selling was primarily due to portfolio insurance, (rational) investors would buy the undervalued stocks – which they eventually did to restore balance.
- While portfolio insurance volumes spiked over the period, L&R highlighted that portfolio insurance volumes were spiking at times when prices were rising, which contradicts the argument that trading due to portfolio insurance was pushing down prices.
- Finally L&R raised the question of what L&R's investors would have done during the crash if they were not invested in portfolio insurance strategies?

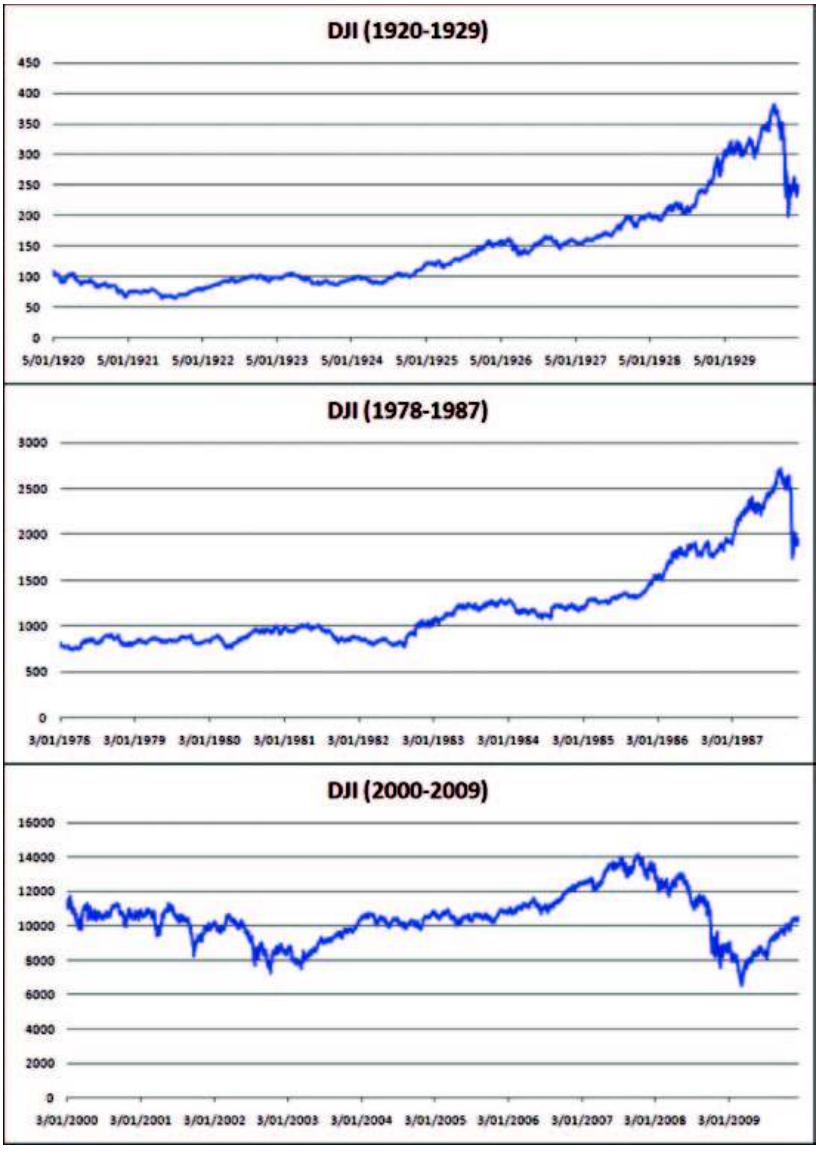
While we will never know the answer to L&R's question, this question does lead to a critical point in the debate. The natural response of most investors in a falling market is to sell. This response was not invented by portfolio insurers, it was just structured. So L&R may be correct that these investors would be selling anyway, but would they have been selling as much? Also, even if they were selling as much, does the algorithmic nature of the selling under portfolio insurance lend itself more readily to exploitation by other market participants, thereby increasing the risks to the financial system?

To analyse these questions we can look further to the past for insight. The crash of 1929 is quite similar to the one in 1987 given that, in both cases an asset bubble occurred in equity markets, which was

ultimately popped. In both cases, poor economic fundamentals triggered the market correction. In the case of 1929 the correction was followed by the great depression, while in 1987 the correction was followed by a long and deep recession. By comparing these events we would expect the existence of a relatively steep correction as well as an "over-correction" in 1987 (relative to 1929) as clear evidence of the impacts of portfolio insurance in that crash.

The actual paths followed by the Dow Jones Index (DJI) in the 10 years leading to the 1929 and 1987 crashes, are depicted in Figure 3. In each case, the market fell by a substantial amount. Given the presence of portfolio insurance in the 1987 crash, it might be expected that any correction would be more severe compared to 1929 due to the forced selling and feedback loop. Interestingly, when comparing the 1929 crash to 1987, we see a larger fall in 1929, which given the economic fundamentals at the time is reasonable and no obvious evidence of an additional impact in 1987 due to portfolio insurance.

Figure 3: Dow Jones Index



As a further contrast, consider the recent global financial crises (GFC). The market dropped further during the GFC compared to 1987, but this occurred over a longer period. Unlike 1987, very large single intra-day drops (or gaps) were not observed and the market had little difficulty absorb the impacts of any forced selling, despite the reduced liquidity and increased prevalence of portfolio protection strategies. The obvious question to ask would be why did the various protection strategies (in much greater volumes than in 1987) not crash the global market this time? The market was certainly falling by a sufficient amount to trigger forced selling. The most plausible answer is that the liquidity and sophistication of the futures market has grown enormously since 1987 and this mature market is perfectly well equipped to deal with the volumes being traded.

What can we learn?

Perhaps the first critical lesson here is that not all investment strategies are created equally and it is important to consider each strategy on its merits when considering potential systemic risks. The suggestion that all protection strategies increase systemic risk does little to inform the debate, just as we add little by noting that all sellers in a falling market increase systemic risk.

We know that investors sell in a falling market due to fear and uncertainty. We also know that this behaviour is responsible for at least two of the three largest market corrections in the past 100 years. Selling in a falling market is a natural response and while behavioural biases will impact short term market volatility, ultimately it is fundamentals that drive the market.

Alternately, observing that leveraged investing increases systemic risk by multiplying exposures and trading activity, we find a conclusion that can be explored. Leverage is a crucial factor and while option exposures are by definition leveraged, it is important to remember that a protected portfolio consisting of an equity or debt exposure combined with an option position is not a leveraged strategy. ▲

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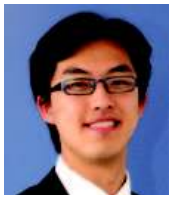

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