Empirics on CPPI Design Risk

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This study aims to critically analyse *design risk* associated with some portfolio insurance strategies. Although the focus is on constant proportion portfolio insurance (CPPI) structures, we also look at other portfolio insurance strategies.

The paper is based upon real market data on several markets indices representing a variety of different risky assets, both from stock and corporate bond markets. Concretely, we rely on observed daily returns over the past 20 years on the indices – SP500 (SPX), Euro Stoxx 50 (SX5E), MSCI World (MXWO), MSCI Emerging Market (MXEF) and iBoxx EuroCorp TR (QW5A). The criteria was to choose indices that have been used in real life CPPI products, either as the risky underlying or as a proxy to the underlying risk portfolio.

In this paper each of indices is considered as the *underlying risky asset* of a possible CPPI structure. Using bootstrapping techniques we are able to empirically simulate daily returns for the assumed *underlying risky asset*. The empirical approach of this study is different from what has been done in the literature as we make *no assumption* on a particular model for the underlying risky asset dynamics, while most studies assume either a geometric brownian motion or a more general model that include jumps. Our results, are thus, *model free and based upon real observed data*.

Using Monte Carlo simulation on the empirical distribution of the underlying asset, we can not only easily find the empirical payoff distribution of portfolio insurance strategies, but we are also able to compute all relevant statistics, not only at maturity but also during the product's life span.

We look into CPPI strategies with different multipliers, but also into the classical option based portfolio insurance (OPBI) and some naive strategies such as the stop loss portfolio insurance (SLPI). A typical portfolio insurance strategy provides a capital guarantee F at

maturity T and some possible participation in the upside potential of a risky underlying asset, if the underlying performs well.

As expected the value of portfolio insurance strategies depend on: (i) F the level of capital guarantee, (ii) T the maturity, or (iii) the value at maturity of the underlying risky asset S_T or, if path dependent, on the actual evolution of the underlying risky asset, $\{S_t, 0 \leq t \leq T\}$.

However in the case of CPPIs, the structure's performance depends strongly (iv) on the multiplier m; (v) the rebalancing frequency, (vi) any possible deductions from the investment (namely fees and/or coupons). We call the dependence of CPPI structures no these variables (iv)-(vi) which are unrelated to the underlying risky asset: *design risk*.

Overall, this study strengths the ideia that CPPI strategies suffers from a serious design problem, making it uninteresting to almost all investors.