

Structured Products for Corporate Risk Management: A Note on Market, Classification and Tail Risk

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Abstract: - Risk management in modern non-financial corporations uses a wide range of derivative and hedging instruments that go well beyond simple forward contracts and options. Popularly known as structured products, such complex derivatives manufactured by financial institutions can often be both difficult to understand and hard to assess and value. Despite their benefits in providing tailor-made solutions to risk management problems, they often come with hidden traps that have been the bane of many unwary risk managers and chief financial officers. What then explains the popularity of such products with corporate treasuries worldwide? What gaps and needs are satisfied by such products which cannot be met by simple contracts? What is the incentive of financial institutions to promote such products? Drawing on real world examples from the world of business this article would shed light on these issues and also talk about precautions that companies need to take to ensure that use of structured products for risk management does not end up creating new risks.

Key-Words: - Corporate finance, Corporate strategy, Financial engineering, Risk management, Structured products, Tail risk

1 Introduction

The tremors caused by the global financial crisis of 2007-2009 were not just limited to the G7 countries, but were felt the world over. According to the International Monetary Fund (IMF), a class of investment strategies called structured products led to total losses of more than half a trillion dollars in companies belonging to over a dozen emerging markets, including Brazil, China, India, Mexico and South Korea [1].

Unlike the cases of financial frauds that one hears about at the hands of the fly-by-night operators, however, for the most part structured products are legal financial securities. Also, the issuers of these securities are typically well-known multinational financial institutions and not unknown unscrupulous brokers or dealers. Despite the losses from such products around the financial crisis and a lull in their marketing for a few years after, structured products continue to play an important role in alternative investments and risk management for high net worth individuals and corporate treasuries globally.

According to the European Structured Investments Products Association, as of the end of the third quarter of 2017 the total market value of designated securities under structured products in Europe's largest financial centers was more than 250 billion dollars [2], with the variety of offerings ranging from simple investment products linked to blue-chip companies to complex leveraged products like accumulators, bonus certificates, reverse convertibles and snowballs.

Despite their benefits in providing tailor-made solutions to risk management problems, they often come with hidden traps that have been the bane of many unwary risk managers and chief financial officers. For a product that is prone to producing such large losses, the size of the market and variety of offerings may seem staggering to an outsider. At the same time, structured products also represent financial engineering at its most creative when it comes to corporate risk management, even if occasionally dangerously toxic.

2 Market for Structured Products

The business of structured products is highly competitive and thrives on ability to discriminate in terms of both the number and size of the offerings. While Switzerland is the world's largest market for structured products, both by variety and volume, one can buy such products in virtually any country which has private banking.

Most of the market in structured products gets made outside public exchanges, and they are predominantly offered to medium to large sized corporate treasuries and high net worth individuals only by invitation or by demand. As we discuss later in some detail, they serve two main purposes: a) giving risk management choices in situations when using plain-vanilla derivatives is either not expedient or prohibitively expensive, and b) providing investment alternatives for cash-rich corporations and individuals looking for risk-return trade-offs not available otherwise.

In certain parts of Europe and Asia-Pacific, however, they are also listed on exchanges, with the majority of the trades by sales volume in Europe accounted for by trades in the Euronext, Swiss SIX, Stuttgart, Luxembourg and Frankfurt exchanges. Hong Kong is the largest market for listed structured products in Asia-Pacific by sales volume, even though it does not list as many products as its European counterparts.

According to the Bank of International Settlements, as of June 2017, the value of outstanding over the counter equity linked contracts stood at almost 500 billion dollars [3]. Although not the focus here, in comparison, the value of equivalent outstanding interest rate contracts stood at near 10 trillion dollars. By any measure, the size of the market is staggering.

2.1 Making of structured products

Different regulators worldwide define the scope of structured products differently, but a typical structured product is essentially a bond embedded with some derivatives-like feature. The cash-flows can be customized in a variety of ways by linking them to the performance of different asset classes and tradable securities.

The US Securities and Exchange Commission's Rule 434 defines structured products as: "Securities whose cash flow characteristics depend upon one or more indices or that have embedded forwards or options or securities where an investor's investment return and the issuer's payment obligations are contingent on, or highly sensitive to, changes in the

value of underlying assets, indices, interest rates or cash flows."

While some of these above features can also be packaged in a mutual fund, the regulatory requirements associated with setting up such funds make it an impractical solution given the different motivations of investors in mutual funds and the structured products.

Embedding derivatives-like features into a bond ensures that structured products are designed to never have a negative value, making the credit risk in the product asymmetric and biased against the buyer. Only the issuer can default, and given that the buyer pays the price of a bond upfront, the issuers need not have any concern for the creditworthiness of the buyer.

This one-sidedness makes it attractive for issuers to offer products based on highly bespoke basket of stocks, interest rates, commodities and exchange rates, or some combination thereof. This also allows the issuers to charge more for offering bespoke combination of assets preferred by the customer. On the demand side it allows investors and corporate treasuries to push for tailor-made solutions from their banks. Clothes at Savoy London do not come cheap, but they are available for those who can afford or need them.

2.2 Risk management perspective

The famous Modigliani-Miller proposition on capital structure irrelevance implies that if shareholders have equal access to capital markets and there are no frictions, risk management adds no value for the shareholders [4].

The reasoning is straightforward. If shareholders can manage that risk on their own, firms need not do so. In fact, there will always be some shareholders who hold the stock just because the firm's capital structure gives them the diversification benefits arising from that firm's idiosyncratic risk.

In practice, risk management on part of corporations becomes important because of the high levels of debt that firms often need, at a scale not possible for most investors to protect against. And high levels of debt come with very real risks of bankruptcy.

The direct costs of bankruptcies are well understood – paperwork and lawyers take both money and time – but companies suffer even when they are perceived to be on a brink of default. As it becomes harder for companies to service their fixed interest payments, it not only gets into difficulties with its creditors, it also starts losing its customers, employees and suppliers. At the same time, even though a large corporation is exposed to many risks,

not all risks are equally survival threatening, so notwithstanding market imperfections, it is not optimal to hedge against all kinds of risks. For example, an American steel manufacturing company hedging against the price of steel will lose shareholders looking to buy exposure to the price of steel. But if that company imports raw material for steel, say, from India, hedging against the fluctuations in Indian Rupee makes eminent sense. And an American steel company may be importing raw material not just from India but from a host of countries.

Even so, it is impracticable and costly to establish standalone hedges using standard products against fluctuations in many different foreign exchange rates however large and cash-rich a company maybe. Both the quantities and the time lines associated with the hedges would have their idiosyncrasies about terms of contract it may have entered into with its suppliers from each country. In such a circumstance, a structured products providing exposure to a basket of global steel companies or foreign currencies would perfectly fit the bill.

It is not only the vagaries of running large businesses that make structured products more attractive. Even though perfectly suitable on face value, the standard forward contracts can often become very costly. Entering into forward contracts with no get-out-of clauses can leave a firm perilously exposed if its competitors have not been hedging using similar contracts. While it may seem prudent for an airline to hedge against oil price risk in isolation, but if its competitors choose not to do so and the price falls, the firm is doubly exposed as it can no longer pass some of the price hike to its customers.

While futures contracts offer the flexibility of early exit not available with forward contracts, they are available and most liquid for only select standardized commodities and foreign currencies. The basis risk associated with an imperfect match between exposure to be hedged and the available hedging instrument often make them unattractive. Even if the basis risk is low, futures contract can only be realistically considered by companies who have the necessary liquidity available to fund mark-to-market payments to the clearing exchanges.

The exchange-traded plain vanilla option contracts are also unattractive for related reasons. While options with at-the-money strikes are liquid and available at fair prices, they are expensive. On the other hand, while out-of-the-money options may be available at select strikes, they are either unfit for the purpose at hand or highly illiquid and unfairly priced. Structured products again fit the bill much

better. Their higher costs are also often better justifiable given the close matching of exposures, cash flows and the hedging instrument used.

2.3 Risk management perspective

The advantages of structured products as an investment alternative are not too different from the considerations that make them useful for corporate risk management.

The classical portfolio theory in finance is very clear in terms of its recommendations to the marginal investor – do not put all eggs in one basket. In the world of Harry Markowitz [5] and the Capital Asset Pricing Model [6], there is simply no role for structured products. Only when one takes into account market imperfections like inability to short stocks and leverage constraints, does there exist a need to go beyond holding the market portfolio. Even with the observed irregularities around the size, value and the momentum factors, from an investment point of view, one still only need include a few additional portfolios. The essential insight of diversification remains.

The need for products with derivatives-like features only arises when one is looking to express out-of-consensus and asymmetric views. Even then, for most investors, exchange-traded call and put options are often enough in terms of implementing their views. Bigger investors, however, are often interested (or advised) to go beyond the limited characteristics afforded by exchange traded products. For example, even the most popular of option contracts do not have the same kind of liquidity for the full range of strike prices and time to maturities.

Structured products also enable tax arbitrage between dividends and capital gains tax. By designing the product to reinvest dividends back into the product allows the issuer to transfer dividend gains into potential capital gains, taxes on which are often lower.

While it is true that largest of such customers are often able to enter into over-the-counter deals with large financial institutions, regulatory requirements make that work only for the largest of such institutions. As the newbie investors at the Brownfield Fund realized to their embarrassment when meeting JP Morgan Chase in the famous movie 'The Big Short', ISDA agreements to enter long-term option contracts can be prohibitively costly in terms of the required capital requirements, and are out of reach for all investors but a select few.

So when one is looking to operationalize out of consensus market views with limited capital, for all

practical purposes there is just no better solution than going with structured products.

2.4 Offering of structured products

Given the nature of structured products, they can only be issued by financial institutions who can manufacture bespoke cash flows from existing exchange traded products and plain vanilla options. This requires expertise of an options market maker and information advantage of a brokerage house.

The ability of option sellers to make market relies on dynamically hedging their exposure by trading in the underlying assets. The Black-Scholes theory of option pricing gives the price of the product as the cost of hedging it through the life of the contract [7]. Pricing customized option contracts are no different, except that their hedging may require using other exchange traded options. The underlying pricing principles remain the same.

However, as they say, 'the only perfect hedge is in a Japanese garden'. All real-world hedges leave some residual risks, which means pricing must go beyond the costs of replication to also include risk management and funding costs. Since hedging is always in the context of some Black-Scholes like model, risk-management costs also include the cost of model being wrong.

There are also economies of scale and scope associated with offering such products. A large options book benefits by netting of variety of residual risks. The famous central limit theorem guarantees that putting many risks together leads to a more well-behaved distribution of risks by dampening non-linearities. While this reduces the risk management costs for the issuer of such products, given the asymmetric nature of the market, the sellers are still able to charge full gross costs from its customers. Given the high margins and the information advantage, financial institutions hire a dedicated team of sales and marketing professionals to preemptively offer such products to their clients. This means that more often than not, structured products are sold and not bought. The oligopolistic nature of the market means that there is also an incentive to strategically complicate structures on part of the sellers, so as to differentiate them from their peers. This means additional distribution, marketing and selling costs must also be added to the price of the product.

Apart from the clients for whom structured products fill a risk management or an investment need, there are always companies with liberal risk management policies with short-term cash surplus looking for high yields and speculative gains. The latter group often forms the largest client-base for

the sellers and distributors of structured products, leveraging long-standing banking relationships and discretionary power with the chief financial officers.

2.5 Behavioral finance perspective

Much of the modern finance theory rests on the assumption that people are rational and can in principle take economically optimal decisions. However, at least since the 1970s there have been growing evidence that people systematically make mistakes when faced with uncertain environments even when the probabilities are well defined. The field of behavioral finance tries to incorporate some of these deviations from rationality in understanding investment behavior, and these are particularly relevant in the case of structured products [8]:

- *Loss aversion*: It has been observed that people evaluate same absolute value of losses and gains differently, and this leads to more demand for products with asymmetric payoffs [9]. For example, despite the poor risk-return trade-off on capital protection products (they are often more expensive than the sum of their parts), it forms the most popular category of structured products with investors.
- *Selectively over or under-weighting low probability events*: Experimental evidence from the work of behavioral scientists suggests that people selectively over or under-weight probabilities attached to rare events [10], and accordingly either end up over-paying for insurance against some rare events (buying expensive travel insurance for upcoming flights) or under-charging for selling insurance against other rare events (buying expensive structured products with implicit short option positions).
- *Mis-estimation of probabilities*: The popularity of structured products with barriers is a strong indication of mis-estimation of probabilities on part of the investors [11]. For example, while the probability of a symmetric random walk ending in a positive value after many years is one half, the probability that the random walk would be positive at some time during its lifetime is close to one. Corporate treasuries often under-estimate the latter and end up paying much more for products that are designed to die when barriers are hit.
- *What's in a name*: Marketing of structured products is no different from marketing of luxury car brands. And just like fancy cars, structured products are designed to have 'good names' associated with positive emotions. Some of the most commonly used adjectives include 'high', 'yielding', 'performance', 'enhanced'

and 'returns' (as the reader would notice, their combination reads HYPER, another commonly found name).

3 Classifying Structured Products

Given the range of structured products offerings, it is neither helpful nor possible to list all possible combinations of structured products across asset classes. Like all things exotic and tailor made, they also evolve with fashion and flavor of the day. Broadly, however, they can still be classified under two broad headings: a) those meant for risk management by corporations, and a) those meant for investments.

3.1 Risk management products: The two fold asymmetry

Structured products are attractive to corporate risk managers because unlike the plain vanilla options which often require substantial upfront payment, structured products are usually designed to be zero cost at inception. Being tailor-made, such products are not only designed to be zero-cost, they are also designed with potential upside keeping in mind the views of the buyer. In fact, it is not uncommon to find companies making money on more than two-thirds of their structured products deals. Prima facie, this seems too good to be true: how can something which has a disproportionate chance of being profitable for the buyer be free, and at the same time still make business sense for the seller?

1. Probability of profit is biased in favor of the company or the investor
2. The magnitude of profits and losses are skewed in favor of the financial institution selling the structured product

The mechanisms that produce this two fold asymmetry varies from product to product. In fact, this is what makes the design of structured products a creative process – as much a work of art as engineering. Even so, certain set pieces are more commonly observed than others.

- *Leverage*: The most common class of risk management products are those in which the notional amount is contingent on the price of the product to which the exposure is linked. For example, an airline might be offered a contract to buy 100,000 barrels of jet fuel a month at a strike price of 10% discount to the market price. If price rises, remains flat or drops less than 10%, the airline makes money. However, if the price drops below the strike, it must buy double the amount at the strike price! So when the deal is profitable, the airline makes profit on 100,000

barrels, but when it turns loss making, the losses are on 200,000 barrels of jet fuel. At the same time, since the strike price was at a discount to the market price, profits are more likely than losses.

- *Callability*: Many structured products are designed with the bank having additional rights to terminate the contract prematurely after few months of the deal being struck. For example, in the case of the airline above, the bank may have the right to terminate the deal any time after the first three months. If oil prices remain high, the airline makes money for the first three months after which the bank will probably terminate the deal. If prices fall, however, the bank sits on the deal for the entire 24 months. In this avatar, losses last for many more months than the gains.
- *Target Redemption and Autocallability*: Target Redemption Forward (or TARF as they are popularly known) is a variant of callability in which the bank does not have any discretion on whether to terminate the structure, but the contract terminates automatically under pre-specified conditions. For example, the deal might say that the contract terminates automatically when the airline has made a cumulative profit of \$1.5 million. This caps the gains that the airline can make while leaving its losses uncapped.
- *Knock-In and Knock-Out (KIKO)*: The TARF discussed above is said to have a knock-out feature as it ceases to exist or dies ('knocks out') under certain conditions. Very often the knock is instead based on market price crossing a certain level (called the barrier). For example, the airline might be offered a contract to buy jet fuel at an attractive price with the caveat that the contract knocks out if oil price rises by more than 20%. Conversely, an obligation may be created with a 'knock in' feature. For example, an airline might be given a contract to buy 100,000 barrels of crude a month at an attractive price with the provision that if oil prices drop by 15%, then the airline is obliged to buy an additional 150,000 barrels at the original price.

3.2 Investment products

From the point of view of marketing structured products as an alternative investment category most structured products distributors classify them in four popular categories in the increasing order of their risks and expected returns.

3.2.1 Capital guarantee

As the name suggests, capital guarantee products come with complete protection on the principal amount (face value of the bond), or a minimum amount as specified by the issuer. There is often limited upside potential either at the cost of all the foregone dividends or at an upfront premium added to the cost of the bond.

One of the most popular products in this category is a shark fin note (name coming from the shape of its payoff diagram as in figure 1), which is a zero-coupon bond with an up-and-out (call) barrier option. In this product if the underlying asset hits a pre-specified barrier, the product ends prematurely with an early return of the principal to the buyer. If the barrier is not hit, however, the product pays the principal amount back at maturity along with the payoff from the call option if it is in the money.

3.2.2 Yield enhancement

The most popular of all structured products traded in European exchanges fall under this category. By limiting the extent of capital protection, they allow for even larger upside potential and hence the name yield enhancement. They are also relatively cheaper compared to their full protection counterparts.

The most liquid and active products in this category are reverse convertibles and its many variants, most common of which is a barrier reverse convertible. The name comes from the fact that the payoff the product is just the reverse of that from a standard convertible bond which behaves like equity when equity is doing well and like a bond when it is not. A reverse convertible behaves in exactly the opposite way – that is it behaves like equity when it is not doing well and vice-versa.

The barrier reverse convertibles are a bit costlier because the downside kicks in only after the underlying has fallen below a pre-specified barrier level (figure 2). Many other variants apply the barrier to a basket of stocks or assets, with often the worst performing asset considered for checking the barrier condition.

3.2.2 Participation and Leverage

Clubbed together, participation and leverage products come next in the riskiness category. They take the risks up by a couple of notches. The capital protection in such products is often limited or none, but they usually come with significant upside potential by increasing the participation in optionality. For example, a participation (often also referred to as the gearing) of 1.2 on a call option payoff at maturity would mean that the product

would pay 1.2 times of what a standard call option would pay if it is in the money.

Participation products are designed by the issuers to provide exposures to custom-made sector-specific stocks or assets (like real estate or commodities), which is either difficult or impossible to get otherwise. The most popular products in this category are trackers and bonus certificates (figure 3).

There is no hard-and-fast clear distinction between participation and leverage products, except that leverage products can be even more expensive as they take up the level of participation on the upside even further. This often comes at the expense of completely forgoing capital protection. The most popular product in this category is the outperformance certificate.

4 Tail Risk in Structured Products

Because structured products are tailor-made they are designed by the seller keeping in mind the biases of the buyer – smart salespersons know how to play to the gallery! So to make matters hard, the downside potential is often hidden in the fine print or is to be understood by reading between the lines.

So if the airline strongly believes that oil prices are likely to rise, it might not pay much attention to what happens to the conditions laid out in the contract when price falls. Similarly, if the airline management is under pressure to improve its short-term performance, it may be very receptive to a deal that offers an attractive price right now ignoring the losses that might arise in the future. Such tunnel vision about tail risks is often the most prominent reason behind many bankruptcies that have come in the wake of the structured products disasters [12].

4.1 When the tail risk stings: The case of Ashanti Goldfields Company

Ashanti Goldfields Company Limited (AGC) was a gold miner based in Ghana. In the early 1990s, it embarked on an ambitious growth strategy of becoming a pan-African gold company. At the peak of its stock price, AGC accounted for more than 60% of the Ghana stock market. While a matter of pride, its market capitalization made it difficult for the company to raise money from the domestic equity market. An aversion to inviting foreign ownership meant AGC's growth had to be financed using debt and as a consequence its leverage steadily grew over the '90s. With a high cost of production and rising fixed interest expense, it was forced to hedge its exposure to gold price risk using

derivatives (even if it didn't want to, lenders would have forced AGC's hand) [13].

By the late 1990s, AGC's hedge book represented about 50% of its gold reserves with a mix of forward contracts, bought put options and sold call options, with maturity of some of the contracts stretching out to 15 years. While many such contracts were entered into in early-mid 1990s when gold price was high, by late 1990s the gold price was in steady decline putting pressure on AGC's profitability and on its hedging program.

While the pre-existing hedge book allowed AGC to remain profitable even as gold price fell to as low as its cash cost of production, hedging the output of future production at such low prices became acutely challenging. So on the one hand, forward contracts would only lock in the rock-bottom prices prevailing in the late 1990s condemning it to dismal profits for years to come, on the other hand, leaving the gold unhedged would expose AGC to high risk of bankruptcy if gold prices fell further.

Although buying put options would have served the purpose, at such low prevailing prices they would have been horrendously expensive. Funding them by selling call options no longer worked because call options were virtually worthless at such low prices (not that AGC didn't try – by 1999, it was selling call options on three ounces of gold for every ounce of put options purchased). AGC was desperately in need of a magic bullet.

And this magic bullet came in the form of structured products, offered to it by a famous bank. By the end of signing the deals, AGC ended up with a whole lot of leveraged knock in contracts. As the gold price hit higher, the number of ounces that AGC was obligated to sell (at preset strike prices) escalated as more and more options knocked in. AGC thought that this was an acceptable level of risk, because half its gold reserves were unhedged, and rising gold prices would give AGC a windfall from the unhedged gold that it could sell at market prices.

The only problem was that unlike with simple products where loss from business is hedged by the corresponding gain in the forward contract or put option and vice-versa, the downside implicit in its structured products were magnified (the two-fold asymmetry). And losses would invite margin calls. Even so, for AGC this would happen only if the gold price would suddenly start rising dramatically.

Specifically, AGC had assurances from its banks that margin calls would begin only when losses crossed the limit of \$300 million, and additional cash deposits would only apply to losses above that limit. And at the time, AGC was sitting on a mark-

to-market profit of over \$200 million. In the mind of the AGC, the scenario of having to make a cash deposit would arise only if gold prices rose so much that the valuation of the hedge book swung by half a billion dollars from \$200 million profit to \$300 million loss.

When dealing with leveraged structured products with KIKO features, this is exactly the kind of tail risk that can come to bite back if ignored. And many corporate risk managers suffer with such tunnel visions when it comes to tail risks. Even after they have transitioned from simple forward contracts to complex structured products, they still think of risk in terms of only price movements. For complex structured products, there are many drivers of valuation, and quite often volatility is as important as or even more important than price.

For AGC, this tail risk came in the form of an innocuous meeting of fifteen major European central banks in Washington on September 26, 1999. The meeting ended with an announcement that they would no longer sell or lease their gold in the market. With an impending shortfall in supply, gold's price as well as its volatility surged. This double whammy caused AGC's hedge book to deteriorate by over \$800 million in a matter of days to swing to a mark to market loss of \$550 million! Faced with a margin call of over \$250 million (\$550 million minus \$300 million), AGC found itself on the brink of bankruptcy and was ultimately acquired by AngloGold.

Nuhu Salifu, a leader of the Ghana Mineworkers Union described the irony of a gold miner being destroyed by a rise in the price of gold: "All year we have been praying for the price [of gold] to go up and now it has, we are crying. It is difficult even for well-educated people here to get to grips with this problem."

4.2 Other famous structured products disasters

Ashanti is not the only one to be bitten by the tail risk. Some other famous disasters include:

- *TARF and KIKO on currencies:* According to the IMF, structured products under the category of TARFs and KIKOs led to total losses of more than half a trillion dollars after the Global Financial Crisis. This was accounted for by more than 50,000 firms from over a dozen emerging market countries, including Brazil, China, India, Mexico and South Korea. At a time when the euro was trading below \$1.30, a typical deal of TARF allowed corporates to sell a million euros each month for the next twelve months at an average strike price of \$1.32 per

euro. The transaction would knock out when the company's cumulative profit reached \$100,000. The catch was that if the euro dropped below the strike in any month, the company had to sell two million euros at the strike price. During 2007, the euro actually appreciated to almost \$1.50 which would have caused losses 20 times the maximum possible profit in the structure.

- *Power Reverse Dual Currency*: Power Reverse Dual Currency (PRDC) were popular investments for Japanese retail investors in 2006 and 2007. At a time when Japanese interest rates were only marginally above zero, and the yen was regarded as a weak currency, the PRDC offered a high interest rate linked to the dollar-yen exchange rate. For example, the interest rate each period could be defined to be as:

$$\max\left(14\% \times \frac{\text{¥}/\$}{120} - 11\%, 0\right)$$

If the dollar was around 120-130 as expected, the interest rate on the PRDC would be about 3-4%. Though the instrument had a maturity of 30 years, it was callable by the issuer at any coupon payment date. During a period of yen weakness, PRDCs were routinely called after a few months, and many retail investors started thinking of them as short term instruments offering an interest rate several percentage points higher than other investments in Japan. During 2008, the yen appreciated to 80-90 ¥/\$. At these levels, when the interest rate on the PRDC went to zero, with no incentive for the issuer to call them, investors were stuck with a near-30 year instrument with zero interest rate.

- *Proctor and Gamble and Banker's Trust*: No discussion of tail risks in structured product would be complete without the swap contract between Proctor and Gamble (P&G) and the Banker's Trust that had to be settled out of court. In November 1993, P&G entered into a deal with Bankers Trust based on a complicated Crazy Formula that effectively allowed it to potentially reduce its interest cost on a five year \$200 million borrowing. Specifically, P&G's borrowing cost would have been lower by 0.75% per annum for five years if the Crazy Formula were to remain negative in May, 1994. The Crazy Formula was designed to rise sharply if US long term interest were to rise, and in particular it was defined (in percentage points as) the ratio of 98.5 times the 5 year US Treasury yield and 5.78 subtracted by 30 year US Treasury bond price. As it turned out, in late 1994 the US Federal Reserve embarked on an aggressive tightening of monetary policy and by

May 1994, long term rates had risen by over 1%. The Crazy Formula was around 30 implying that P&G's interest rate cost would rise by 30 percentage points. Over the five year life of the borrowing, P&G would have lost more than the entire \$200 million principal in the form of higher interest costs. After a notorious litigation, P&G settled by paying about \$100 million.

3 Some Practical Takeaways

Many corporations treat their treasury department as a profit center rather than a cost center. Even those that do not do so allow their treasuries a great deal of discretion in hedging. Some treasuries also have the mandate to invest short term cash surpluses into instruments which maximize their yield. As a result of all these factors, many corporate hedging programmes partake some of the characteristics of investment or even speculation rather than pure hedging. Structured products therefore appeal to the hedging and investment needs of many corporate treasuries.

When corporate treasuries use structured products, they need to be mindful of their complexities and non-intuitive characteristics. Unlike simple forward contracts which are straightforward functions of the market price, these complex products depend in highly non-linear ways on many other variables like volatility, correlation and 'volatility smile' that only derivative traders obsess about. Corporate managers should be aware of the two fold asymmetry of these products: probability of gain is biased in favor of the company, but the magnitude of gains versus losses is biased against the company. This asymmetry makes it critical for managers to evaluate low probability scenarios that are otherwise often ignored in normal business decisions.

When using historical data to get a sense of these products, it is essential to consider as long a time period as possible because rare risks would be visible only in such long samples. Banks that are trying to sell these products would by contrast, focus on the more recent historical data that might show the product in a good light.

As highlighted earlier, in practice most structured products are designed to exploit behavioral foibles and biases of human decision makers. Managers must be especially conscious of such frailties and learn to guard against and correct for these biases while evaluating these products.

Companies that use these products should do so within the framework of well-defined corporate risk management policies that define the range of risk management practices that are permitted. It is also a good idea to require sign-off by multiple decision makers to avoid the risk of a single naive or rogue risk manager committing the organization to a contract whose downside risks may be very large.

4 Conclusion

Risk management in the modern corporation involves managing a wide range of risks – exchange rates, commodity prices, interest rates and weather, to name only a few. Most of the time, the top management also has its own views on what prices are likely to prevail in future, and these views are often out-of-consensus and asymmetric. In this context, the vagaries of running large businesses and idiosyncrasies of exposures make structured products an attractive alternative for risk management as compared to more traditional hedging instruments like forwards, futures and plain-vanilla options.

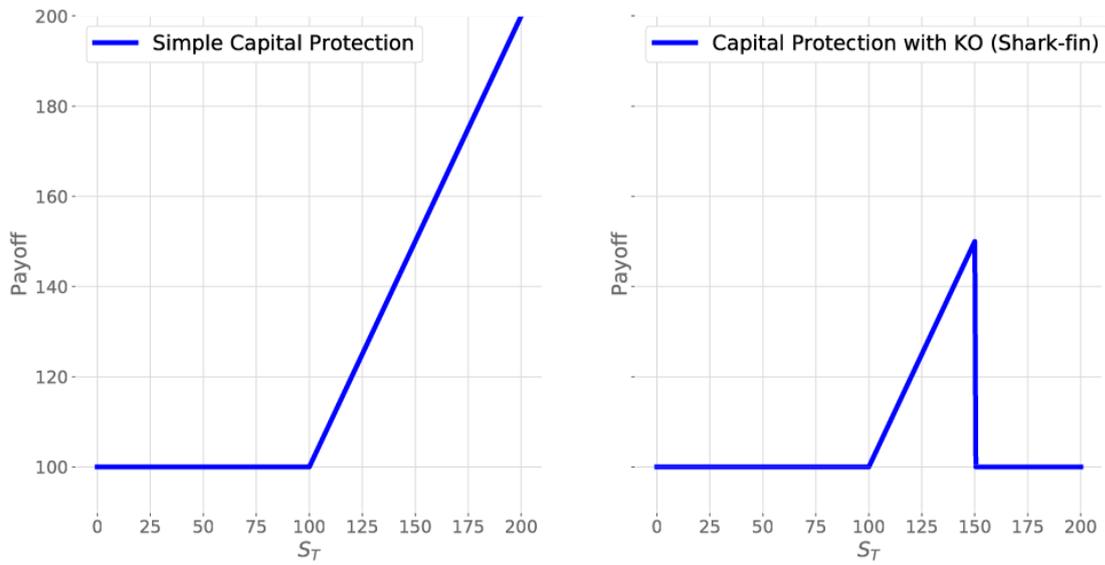
While in principle forward contracts and options can also be used, they can often become very costly when evaluated with respect to the competition. Be it the no get-out-of clause in forward contracts, basis risk and need for cash liquidity in futures or the cost of near-the-money options, all make structured products a much superior alternative for corporate risk managers because of the closer matching of exposures and cash flows.

Structured products do however often come with traps for the unwary in the form of catastrophic tail risk. The two fold asymmetry (of probability versus magnitude of losses) implies that managers need to carefully assess low probability scenarios which they tend to ignore in normal business decisions. Tunnel vision can be costly when dealing with tail risk in structured products. Robust risk management frameworks are essential to evaluate and manage the risk of these products and prevent risk management from itself becoming a source of risk.

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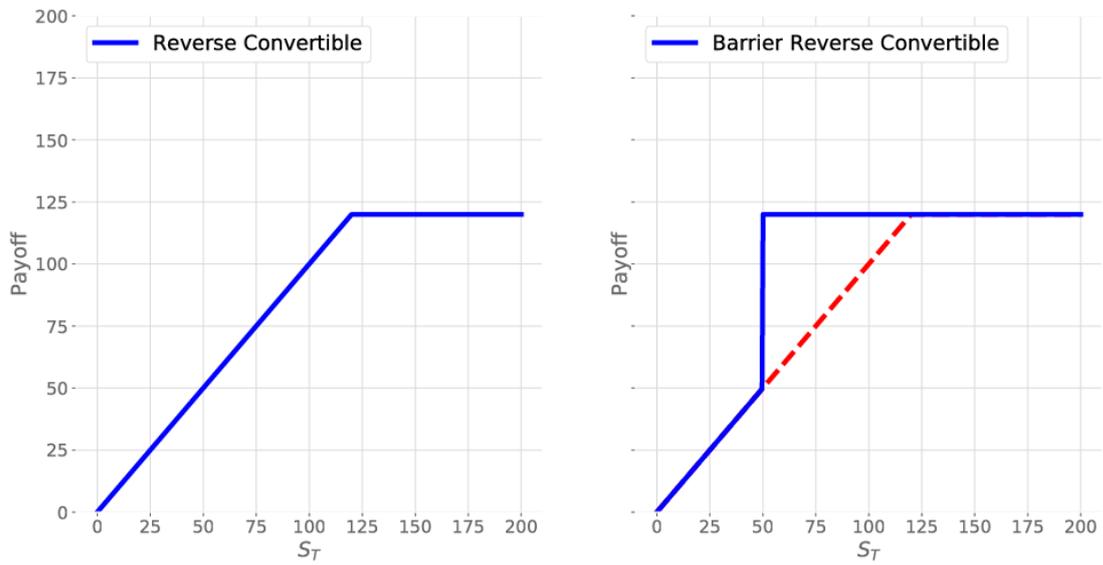
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Figure 1
 Examples of capital guarantee products with and without knock-out (KO)



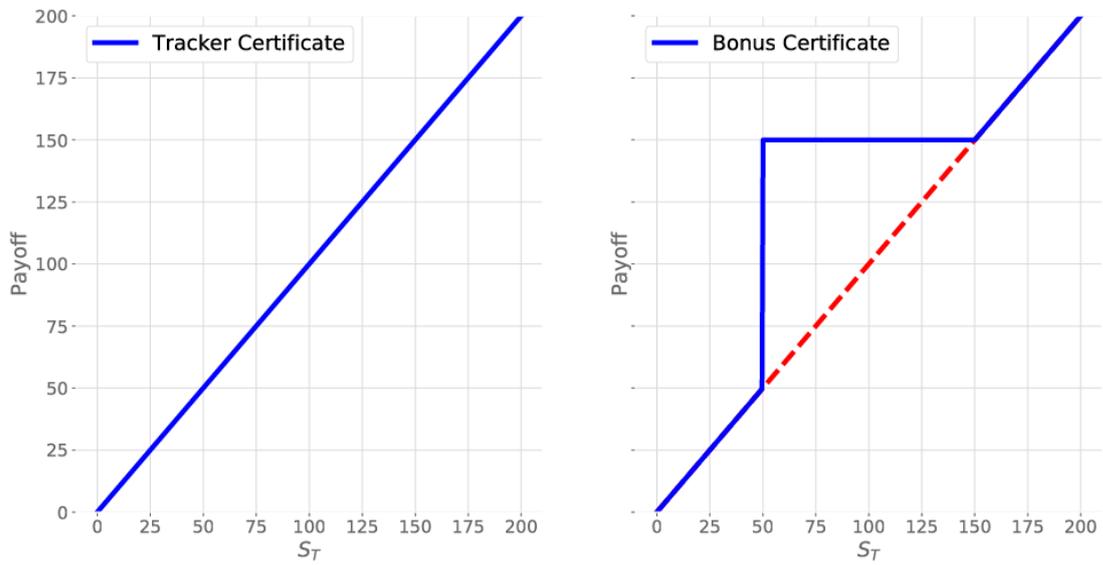
Source: Authors' own calculations

Figure 2
 Examples of yield enhancement products



Source: Authors' own calculations

Figure 3
 Examples of participation and leverage products



Source: Authors' own calculations