Credit Tails

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Introduction

When times are good, investors take on more and more risk. One day they offload this risk, maybe voluntarily, maybe not. The ensuing flight to quality may cause a gradual market downturn or more likely lead to a collapse. This description could be applied in general to a financial crisis but could also be used to describe the recent "sub-prime meltdown". In theory mortgages, even NINJAs[1], were thought to be relatively safe since they were secured by a home but the recent surge in US subprime defaults has redefined the market perception of mortgage risk. Assets have fallen in value because of the rising levels of defaults and the increase in the (subjective) probability of defaults. Volatility has increased as investors headed for the exit. The commercial paper (CP) market which manages short term liquidity has seized up making the "rollover" of short-term obligations impossible and exaserpating the liquidity problems. Indeed, the crisis overall is predominantly a liquidity one with corporate defaults remaining at zero. Looking back, risk premiums had hit a record low back at the beginning of 2007 across a very broad base of assets. Credit spreads had ground to historic tights and innovation and complexity were running rampant in order to provide the (high leverage) structures that could promise the required returns. Arguably there was an efficient transfer of risk, indeed as proof of this German Landesbank portfolios and Asian funds have been impacted by the US subprime crisis. Spreading risk around is a good thing but potentially creates the problem that it is harder to predict what would happen in a severe systemic event.

We should emphasise that the 2007 credit crisis was not really caused by the problems in the subprime space. It can be argued that the seeds for the crisis of high leverage were put in place during a period of lax lending on many fronts ranging from US real estate to hedge funds and the increasing leverage created by CDO structures to structures such as SIVs which can now be seen to have taken severe maturity and credit risk with very little equity to buffer potential losses. The combination of innovation, issues in pricing and risk management and opaque nature of some of the products together with high leverage have created a nasty cocktail with a rather unpleasant hangover which is hard to shake off. When asymmetric information exists in a market, sudden price changes, not entirely driven by news, are conceivable. Subprime was arguably just the catalyse that suddenly made creditors realize that the risk they had taken on was disproportionate to the returns they were getting.

As with the May 2005 "Correlation Crisis" a lot of attention has been focussed on financial models and their potential misuse in the credit world. The complex models used to "value" subprime mortgage risk have been highlighted as being highly suspect

[1] NINJA stands for "no income, no job and no assets".

as they overlook sudden market downturns and liquidity. Is the crisis the fault of the financial engineers who spend their days thinking about stochastic processes, default correlation and extreme value theory rather than joining the real world? Are the rating agencies to blame for quickly rolling out ever more complex models for the innovative products hiding more and more leverage? Have banks been niavely building up gap risk under the assumption that such gap events will never happen? This article will aim to highlight some of the problems and challenge on the modelling front and offer some solutions. One theme I will point to is that the structured credit market is simply suffering the same problems that have existed in other more developed markets, potentially magnified by the explosive growth of the credit derivative market. At the core of the problem is that structured credit is defined by relatively rare credit events and co-dependency that is hard to characterise and measure. I will also argue that we have to look far beyond the actual models to their actual use, intended or otherwise, and the impact they can have on the market.

I will make a broad division between *objective* and *risk-neutral* models with the differences between the two being important when we consider where and if they indeed failed. The former category will refer to approaches representing economic representations defining price via a fair value adjustment of credit risk. For example, a price of $99.5 might be derived via a risk-free value of the security as $100 and a fair value assessment of a 50 cents price of credit risk. The rating agency models are clearly an example of this although they represent the price via a rating. Secondly, I will discuss the risk-neutral models which are used under the implicit assumption that there exists some underlying hedging strategy that provides justification as to the price. This refers mainly to the much maligned “Gaussian copula model” and associated “base correlation” approach.

PART I. Objective models

As mentioned above, the term objective models covers approaches representing a price as a fair value assessment based on some economically motivated model, augmented with historical data. This broadly covers several areas: -

- i) Rating agency models – since a rating can be thought of a discrete representation of a price defined by expected loss or probability of default.
- ii) Fair value models – used by investors to price products that are illiquid.
- iii) Gap risk models – used by issuers to assess the price of the gap risk they retain when issuing a structure such as CPPI.

What’s in a rating?

The rating agencies have taken easily their fair share of criticism in the last few months. One can argue that they are strongly incentivised to produce more complex models above key concerns since they effectively get paid for giving out top ratings. However, anyone with just a simple overview should be aware of the limitations of their assessment of the risk of a structured credit product. The rating agency approach can be broadly summarized as the design of an economically motivated model, parametrized with historical data, which is then applied to the product cashflows to produce a single measure of risk (typically expected loss or probability of default), mapped to a rating. It should be fairly obviously therefore that the rating agencies are making an assessment of the risk of not receiving promised returns on a single product under the assumption that history provides a reasonable prediction of the future. Given this point, they are not obviously doing anything badly wrong. There is a big difference between credit worthiness, which the rating agencies attempt to quantify and market price, which they do not. Maybe institutional investors rely to heavily on the ratings of structured credit products such as CDOs to make investment decisions.

The rating process for synthetic CDOs is a relatively transparent one. Sectorial correlation assumptions are applied to the portfolio in order to effectively transform the ratings of the constituents to those of tranches. As long as we are happy with the correlation model (more importantly the actual levels of correlation in the portfolio) then there is seemingly little to critisise. Things become more tricky when we consider the more complex products. For example, a CPDO will "roll" every six months by unwinding the credit protection sold and selling new protection on the current index. Because the current index is longer-dated than the old index, it normally trades at a wider spread which gives the CPDO extra income. However, if the new index trades inside the old index, there are losses which are quite likely since it is the "blown up" or downgraded credits that are removed from the new basket and replaced with "average" spread names. A model may not capture the reality that over half the widening of an index can be apportioned to a relatively small number of names[2]. In theory, a dynamic leverage structure should be able to make back any losses from roll costs, spread widening and defaults, they are after all typically 10 year structures and increased volatility is a good thing as long as they do not accumulate sufficient losses to "knock-out". But the difference between a CPDO that eventually returns full coupons and principal after a highly stormy ride and one that completely de-leverages it its early years may be rather subtle. The rating models required for such structures are by necessity an order of magnitude more complex, involved spread process assumptions (volatility, mean reversion and even explosiveness) and this creates greater uncertainty in the ratings process.

The same is true of the rating agency approaches for other complex products such as the waterfall logic inherent in most cashflow CDO transactions can be extremely challenging. A further complication arises in rating structures such as CDPCs (Credit Derivative Product Companies) since a ratings based capital model is an integral part of the day-to-day running of the vehicle. To calculate the true risk would require simulating the impact of this capital model over time which is clearly impractical. The rating model is therefore a necessary simplification of the actual operation of the CDPC.

Mark-to-what!?

Mark-to-model represents a procedure to obtain the fair value of an illiquid product using unobservable inputs. Because CDO securities trade infrequently it is difficult

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[2] For example, almost 60% of the widening in the CDX 5Y index between October 12th and November 5th 2007 came from just 10 of the 125 names. Source: Barclays Capital Structured Credit Research.

for investors to value or "mark-to-market" their positions. Instead they may rely on their own proprietary techniques to mark-to-model. Such approaches may be quite challenging to develop: for example for valuing an MBS tranche, one cannot assume it is wiped out by a single event nor can one model each mortgage individually. However, none of these points represent a worry for your average quant, well versed in stochastic calculus and commanding a vast array of statistical, mathematical and numerical skills. A well-chosen range of tools from the quants toolbox will lead to the development of a model which can be parameterized with historical data and then used to predict the future.

A Close Shave with Ockham's Razor

William of Ockham was a 14th Century logician who is well-known for his theory known as "Ockham's razor" which, paraphrased states that "all things being equal, the simplest solution tends to be the best one". Perhaps the Einstein quote, again paraphrased of "theories should be as simple as possible, but no simpler" is more accurate here. Objective models may make unrealistic modelling assumptions and rely on data that may not be representative of the future. Any significant deviation from history will almost by construction invalidate the model. The point could be made that rating agency approaches are unnecessarily complex. The problems with mark-to-model approaches missing liquidity and the fact that some of the older CPDOs on index portfolios have been put on review for downgrade may give little confidence in these very complex models. A more simple and transparent treatment will be more easily understood and the limits of the methodology will be clearer.

Objective models may be over-complex, rely on unrealistic distributional assumptions and be poorly parameterized yet strangely this is not the most significant concern which is that at the very best they are used to define a single statistical quantity. The point is not really that the models ignore liquidity (since any extreme event such as this would be probability weighed by a small likelihood of occurrence) but rather that market participants ignore liquidity by relying on single measures to summarize what is rather complex. Contrast the application of value-at-risk (VaR) models in market risk management, which are constructed to produce a daily "worst-case" loss metric for the portfolio in question. The market risk confidence level is typically 95% which can be empirically tested via computing the number of times the VaR is exceeded (which should of course be close to 5% if the model is performing well). Judged on this basis, typically VaR models can be accurate[3] to around 10% which seems like a reasonable performance given the relatively complex multi-dimensional nature of most derivatives portfolios. Furthermore, assessing an event with a daily occurrence of one in twenty, the inability of the model to capture extreme events is not so concerning, after all this is not the purpose[4]. Whilst the application of models to

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[3] It should be noted that there are plenty of people opposed to the market risk VaR concept, claiming that it gives a false sense of security to risk managers, senior management and regulators. However, this seems more to do with misunderstandings of the meaning of VaR such as that losses of several times the VaR are highly improbable – under Gaussian assumptions a loss of 3 times a 95% daily VaR number is a 1 in 10,000 year event!

[4] Such events (which are often frustratingly referred to as 10 standard deviation moves or 1 in 1 in 1,000 year events) are more the realm of stress testing.

assess daily 5% probabilities is realistic, the computation of the much smaller probabilities that correspond to triple-A ratings or fair value prices of structured credit products is more troublesome. Rather than a 1 in 20 **daily** probability, we might be assessing something close to a 1 in 1,000 **annual** occurrence. A depressing implication of this is that there is no prospect of ever conclusively verifying the model. If my triple-A tranche priced at $99.5 takes a loss in year one then I might have to wait a further 999 years to start to appreciate whether this is bad luck or a catastrophic failure of the rating and mark-to-model approach. Even investing in 1,000 products with the expectation that 1 a year will fail is not relevant as objective models and rating makes no representation of the "beta" of the underlying risk.

In summary, an objective models for pricing credit may be little more than a black box, taking historic data and producing a single measure of price, probability or worst case scenario that can neither be justified theoretically nor empirically tested to any degree of accuracy. If such models are developed with intuition and flair then they may add value for understanding rather complex risks. Prop desks and hedge funds have been remaining optimistic in their valuations in the face of suggestions that their mark-to-model is extremely aggressive. This has led recently to terms such as "mark-to-myth" and "mark-to-make believe" being used to berate these model based approaches. The point is that it is not so much a problem with the model but rather the mis-use or over-use of it. Ten sigma events, unknown unknowns, Black Swans - call them what you will they - are not predicted by studying normal distributions, mean reversions, credit migration probabilities and correlations. A good or bad model will be defined less by the assumptions made and more by the context in which it is used and its impact on the financial markets. As I will argue now, overuse of a good model is worse than under use of a poorer one.

Structured credit and self-negating prophecies

You may not know that the first CPDO was called Surf and created by ABN Amro but you are probably aware that a CPDO is a triple-A product paying 200 bps (which might seem like a contradiction in terms). Ideas in the financial world can and are copied quickly – there is no patent protection on clever structured products. This means that "good" ideas are reproduced and modified quickly which can lead to a huge volume of effectively the same product hitting the market in a relatively short space of time. This may negate the very assumptions that led to the development of the product in the first place. For example the CPDO roll will now be driven by many more buyers (sellers) of protection on the new (old) index. A starker example is a leveraged super senior (LSS) transaction where one critical question to ask is the level of super senior correlation[5] in the event unwind or de-leverage. Very likely, the key determinant in answering this question is the amount of LSS that needs to be unwound (if this was not clear before then it was certainly well illustrated in August 2007).

Consider the SIV and SIV-lite structures (the latter just a more highly leveraged and simplified version of the former). The leverage of a SIV means that as the prices of

[5] Most of the rating agencies have not rated market value trigger LSS contracts which could be taken as a realisation of this point.

the underlying assets declines, the NAV of the capital note reduces at a magnified level due to the leverage. Hence, a 1% price drop on all assets across the portfolio would result in the NAV declining by 10%. A SIV will typically have a market value trigger when the NAV falls to a level such as 50% that will impose operating restrictions until it passes the market value test. Since SIVs invest in highly rated debt, it could be argued that any short term losses will be recouped over time. However, any SIV failing to achieve this will be contractually forced to sell assets, creating even more downward pressure and concerns leading to a funding squeeze. A SIV entering a so-called enforcement state will have a negative effect on other SIVs via price pressure and funding issues.

The self-negating prophecy is not specific to credit. Traditional CPPI, or portfolio insurance, a technique of automated selling that was supposed to limit the downside exposure to the stock-market instead probably acted as an accelerant in the 1987 crash due to similar price pressure arguments as above. Another problem that one might identify is the difference between correlation level and skew in market and that used by rating agencies. In a sell-off, high correlations may be created and this may put pressure on rating agencies to revise their historical correlation estimates. Similar things are seen in other markets, for example, that implied volatility can drive historical volatility (rather than the other way around as often assumed) as a result of rapid delta hedging in volatile conditions.

No free lunch after the credit crunch

In November 2007, a financial guarantee company took a charge of over $200m related to a "net unrealised market valuation loss related to a super senior credit default swap portfolio" although the company also stated that it was "highly unlikely" that such contracts would require loss payment. I believe a special case of the analysis of objective pricing corresponds to the senior part of the capital structure. Given the shortage of investors willing or able (for example due to price volatility and cost of capital) to take this risk, there has been a clear incentive to develop other ways to package it. Financial guarantee companies are triple-A rated and provide insurance for investment grade transactions in structured finance. They are typically not required to post collateral on decline in value of contract even in the event of a downgrade in their credit rating. Derivative product companies (DPCs) are similar in concept but take on risk in the form of derivative contracts rather than insurance policies. More recently Credit DPCs or CDPCs have joined the market as triple-A sellers of (uncollateralized) senior and super senior credit protection. A special case of a CDPC is the so-called leveraged super senior structure (LSS) which it like a single trade CDPC with a pre-specified unwind or de-leverage. A buyer of protection via LSS or from a CDPC will likely use a subjective model to price their gap or counterparty risk.

A LSS structure represents an investor selling protection a super senior tranche which will clearly only ever take losses in an extreme credit meltdown[6] but will be unwound

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[6] Take the iTraxx [22-100%] tranche as an example: this will require 40 credit events at 30% average recovery value before suffering any loss[6]. This means that almost one third of the investment grade portfolio needs to default before the investor loses any principal.

half-way to this event. It may evoke parallels with the Mark Twain quote[7] "A banker is a fellow who lends you his umbrella when the sun is shining, but wants it back the minute it begins to rain". LSS protection seems to be priced via the following (false) argument: -

LSS Protection = Leverage × SS Protection – Gap Risk.

Due to the transparent nature of the LSS structures (compared to vehicles such as SIVs and CDPCs), they are an ideal candidate for applying more rigorous risk-neutral pricing ideas. Indeed, it can be shown (Gregory [2008]) that the "gap risk" pricing approach makes implicit and flawed assumptions and a risk-neutral approach is the only rigorous way to value the structure.

The observations made above on LSS should also apply to structured finance vehicles such as SIVs and CDPCs although the application of risk-neutral pricing is more problematic due to the opaque operation of the vehicles. The assessment of a CDPC having a triple-A rating under an objective assessment seems to be to have little value for a counterparty buying protection from them. A protection buyer buys protection on a tranche say corresponding to losses in the range $[A, B]$ but knows that the CDPC is effectively collateralised by a much smaller amount say α. In event of the tranche being wiped out, this amount will not cover all the available losses. Hence the counterparty is relying on some earlier unwind or restructuring without which it is impossible to argue that the protection is worth anything more than a $[A, A+\alpha]$ tranche. Indeed, in a wind-down mode, the CDPC may still be rated triple-A by virtue of the fact that the assessment of losses by the rating agency is still within the relevant thresholds. This may give little consolation to a swap counterparty who has to recognise that the tranche he has protection on is something $[A, A+\alpha]$[8] rather than $[A, B]$.

PART II. Risk-neutral models

The price obtained from an objective pricing model can be argued, especially least in times of stress, to be of limited use. On the other hand, the appeal of risk-neutral valuation is that the price can be justified by reference to a replication strategy achievable via dynamic hedging. Dynamic hedging is a theoretical ideal which is more challenging in practice, especially for credit. However, models of this type are invaluable since in normal market conditions they tell you how to hedge via neutralising first order moves. This unfortunately means that risk management of synthetic CDOs has generally been based on assumptions of first order moves and simple correlation measures and much less so actual experience.

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[7] The triggers are typically at a point half-way towards the trigger in terms of the value of the tranche. Due to the fact that a crash will not occur in a linear fashion, Jensens's inequality would suggest this to be significantly more than half-way to the actual crash scenario. A more accurate quote might replace rain with the point at which thick dark clouds cover the sky!

[8] A further complication is that α will be stochastic due to the presence of many other counterparties to the CDPC.

Feeling based out

If you search for criticism of the Gaussian copula and base correlation approach (GCBC) one practical illustration of its failure is often given via the variation in tranche deltas[9]. An example that might be given is of selling [0-3%] equity protection and hedging with the index. A significant widening of spreads will typically cause the delta of the [0-3%] tranche to decrease rapidly and so creates an unpleasant negative gamma. This situation can be even worse if the equity is hedged with another tranche such as the [3-6%] junior mezzanine since a spread widening accompanied by a steepening of the correlation curve means that the hedge can magnify the loss! Failed CDO delta hedges may then further exasperate market volatility. Using such an example to illustrate the weakness of the model misses the point somewhat - delta does not hedge anything except a very small move in underlying. For larger moves, gamma and cross-gamma (in this case the dependence of moves between correlation and spreads) play a key role. This phenomenon is not specific to credit. Hedging the interest-rate risk of a swaption with a swap depends on the behaviour of swap rates and volatility. For extreme moves this may not obvious and can also be impacted by supply and demand. This may lead to the view that the models delta is "wrong". Just as we might argue that the current credit models have performed badly in 2005 and 2007, we can point to similar problems regarding the Bermudan swaptions approaches in the 90s.

There are two obvious reasons why the "cross-gamma" problem is more acute in credit:

i) Spreads can readily double or even half in a relatively short space of time whereas moves of similar proportions in interest rates, equities, FX and commodities are less likely.
ii) Whilst options have always the same sign vega, correlation can have the impact of both increasing or decreasing the value of a tranche which may not be monotonic in a certain range. A mezzanine tranche that is short correlation can become long correlation if spreads move sufficiently.

The key point that seems to be missed is that a better model is not a way in which to improve delta hedging. The current market standard approach is criticised in many ways many connected with the presence of arbitrage in prices. But all these points should be secondary to the assessment of the hedging capabilities of the model. If the model is tractable and fits the market perfectly then the ability to calculate hedges and explain P&L variations might be rather good. Improved models are typically accompanied by better hedging strategies. Why not understand fully the problems with the hedging in your current model before you try and make the switch?

So no new models then?

Base correlation provides a quite appealing way in which to price bespoke CDO tranches with reference to traded index tranches. The use of a practical measure such as correlation is this linkage is intuitive. Before appearing to be wholeheartedly

[9] A tranche delta is typically quoted as the sensitivity of the value of the tranche to that of the underlying index. Junior tranches have high deltas and senior ones have small deltas. A typical delta on an equity tranche can be around 20 times depends on spread level and maturity and correlation.

defending the GCBC standard it might be time to highlight what is actually wrong with the approach (as opposed to what it gets blamed for as a matter of convenience). BCGC requires a rather steep correlation skew in order to fit the market. A direct implication of working with a non-flat correlation curve is that when calculating deltas and other greeks, we have to decide how to factor in changes in correlation. A common rule is the so-called sticky delta which essentially assumes that correlation will be unchanged for the relevant credit spread move. But one of the key uses of base correlation is to transform a correlation curve to price a bespoke portfolio. If we can price a bespoke tranche on a 40 bps portfolio and also one on a 41 bps portfolio then surely this should be consistent with the definition of the credit delta of each portfolio. Herein lies the main issue; since the correlation curve is far from flat, the calculation of a credit delta requires some heroic assumptions on the behaviour of correlation with respect to spread moves. Sometimes the correlation contribution to the delta is greater than the spread contribution! This is bad - a delta hedge should not be a correlation hedge. Hence there is clearly some significant benefit in having a model with a flat correlation smile, i.e. one that fits the market prices. Given the amount of effort that has been put into finding such an approach (for example see Burtschell et al. [2005] and Ferrarese [2006] for review articles), it is maybe surprising that the Gaussian copula approach has persisted.

The role of the bean counters

Accountancy changes have played a key role in shaping today's derivatives markets. Initiatives such as IAS39 (financial reporting standards for financial instruments) means banks are forced to mark-to-market and not to model. The price is the price, whether or not it is irrational and incompatible with a model. One of the results of this is that risk-neutral prices are not as model driven than they were a decade ago. Supply and demand is the dominant factor in explaining prices and all the emphasis has to be put on calibrating a model to the market, even if this ends up with something rather unlikely. Models are not there to express a view even on small implausibilities, they are there to interpolate and extrapolate market prices.

Approaches such as BCGC work well because they can be easily calibrated to the market. Even the simple extensions of copula models require reasonable calibration effort for even an approximate fit. The market is driven by a strange force that equates supply and demand and the dynamics of such a force are not easy to capture in a few equations. Not surprisingly then that the market has persisted with the approach that is heavily flawed but fits prices perfectly! A problem with this accounting driving approach to model development is that there is less incentive to produce good models based on fundamentals and robust theoretical constructions. A model with enough flexibility can be made to match market prices, without necessarily capturing reality in any significant way. We should clearly be improving the underlying model but without forgetting the need to match market prices. With this in mind, an approach such as Garcia et al. [2007] would seem to represent a step forward in terms of a reasonably simple way in which to flatten base correlation curves. Such ideas should not be rejected on the basis that they do not represent a major change or direction or complete solution.

A price is a hedge

Whilst there has been a huge amount of interest in pricing structured credit derivatives, there is seemingly very little associated research on risk management implications[10]. This would seem to be an obvious point in any asset class but is particularly critical in credit modelling, for example: -

i) Credit product by their very nature involve underlyings subject to jumps which cannot easily be hedged.

ii) One of the main pricing issues is the "mapping" of tranches of a bespoke portfolio to one of more index portfolios. Since each portfolio has many characteristics, this exercise is not one that can be expected to have a purely theoretical solution.

Of course any new model can be assessed in different ways such as its dynamics, arbitrage-free characteristics, pricing of non-standard products and the ability to reproduce market prices. But the ultimate test of a CDO model should be its ability to actually provide a good hedging strategy that is practical.

Where do we go from here?

A repricing of risk has occurred, not just in the subprime credit markets but across all capital markets. We could also argue that the problem is not necessarily best described as a liquidity one. The problems did not arise as a result of lack of physical cash but were rather more due to high leverage and psychological factors caused by an asymmetric information problem. Models are typically not to primarily to blame, rather the problem lies with lack of transparency and many people ending up with the same trade and heading for the door at the same time. However, whilst models can improve understanding and transfer of risk, they can also act as self-negating prophecies and magnify market downturns (the most famous financial model of all time has experienced both there extremes and in Black-Scholes terms, the market drops of 1987 were impossible in the lifetime of the universe). The tipping point at which we transgress from positive to negative model behaviour may be hard to assess. One theory might be that by assuming excessive randomness, models may help to avoid such extreme market situations. This would clearly equate to being overly conservative about objective pricing or assigning triple-A ratings to complex risk.

For the average investor a single measure is much easier to understand than a multi-dimensional one. Rather than being critical about rating agency approaches, we should accept that there are many fundamental problems with quantification and representation of tail risk via a single measure. In a similar vein, whilst objective models are no doubt useful for fair value pricing or assessment of gap risk again to distil all information in a single number, the price, is bound to mislead and cause false comfort.

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[10] As was recently pointed out to me by Jean-Paul Laurent a survey of the credit modelling resource defautrisk.com shows that there are around 1,000 papers on pricing but only 10 dedicated to hedging issues!

What is strange in the credit market is that the use of objective models for pricing of complex products has been widespread and yet for the risk-neutral approaches (where the concept of price actually has some justification) this practice is essentially outlawed. Marking to market for regulatory purposes using models for risk management are inextricably linked and yet are partly driven apart by regulatory requirements. There is no right model to explain market prices in a technical market. Any model that fits the market precisely is likely to beat ones that do not. There should be renewed effort, hopefully incentivised by practical restrictions, on developing "good" models which will be judged on their risk management abilities. Since the very nature of credit gives rise to partially unhedgable risks, it is also important to ask to what degree we combine hedging with high level management of book level risk, for example via scenario analysis.

In theory the re-pricing in the credit markets should mean there is less pressure for complexity and leverage. On the other hand, complexity may be needed to produce products with characteristics such as reduced price volatility and to avoid the self-negating prophecy that may otherwise lead to massive issuance of the same product causing market situations that inevitably undermine the original idea. So sophisticated models are definitely needed and can be used for innovation and tackling new assets classes such as ABS and MBS and complex structures such as LSS. But remember that a price is nothing without a hedging strategy. If you have the choice, choose dynamic replication and not subjective guesswork.

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