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FTD Baskets

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FOREWORD

First-to-default baskets (“FTDs”) are relatively simple correlation products that have gained popularity with investors over the past few years. They have straightforward structures and small reference baskets that can be tailored to investors’ credit control requirements. Investors can take a leveraged position for enhanced yield, or they can express their views on correlation between reference entities or on spread widening/tightening.

In a tight spread environment, yield-hungry investors face the choice between moving down the credit curve to take direct exposure to higher yielding (higher-risk) names, or taking structural risk (leverage) on names that they are more comfortable with. Many choose the latter path. As demand has grown, dealers have begun to offer a menu of FTD baskets for investors to choose from, and commit to provide liquidity to them. This is a major step forward because investors no longer have to completely give up liquidity when taking the path of “leverage for yield”. It also enables them to express their views on credit and/or correlation, not only for the standard 5-year tenor, but also over shorter terms.

To enhance liquidity, dealers have pushed for standardised documentation. In response, the International Swaps and Derivatives Association (“ISDA”) published a standardised FTD confirmation in July. This facilitates another significant development: dealers have started trading standardised baskets, based on the Dow Jones iTraxx sector indices, with clients and between themselves. This means that FTDs offer not only tailor-made solutions for long-term investments, but also commoditised instruments to trade on credit and correlation. This is a sign that the sector is maturing.

In this report, we analyse FTD structure, pricing, hedging and investment strategies. Section 1 explains the payout structure of FTD contracts and the implications for investors and dealers. Section 2 reviews the recent development of standardised FTDs and their potential benefits to investors. Section 3 examines FTD valuation parameters, focusing on the effect of correlation. Section 4 unveils a dealer’s hedging behaviour and analyses delta-hedged FTD trades. We conclude in Section 5 by summarising the main investment strategies involving FTDs.

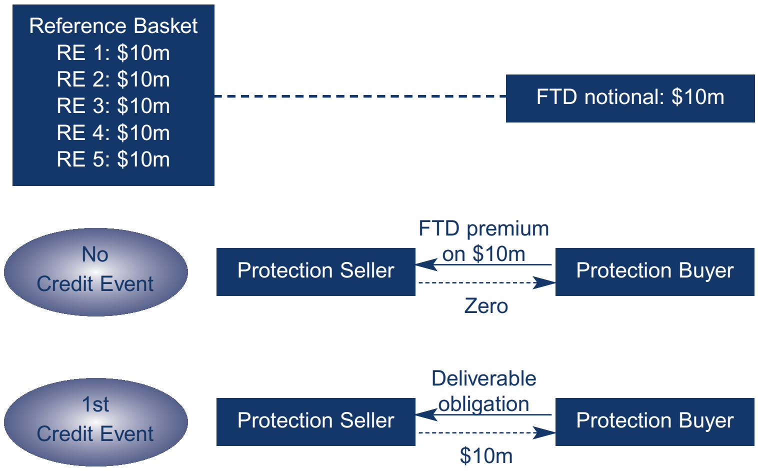
We would like to thank our colleagues Eric Lepage and Jon Gregory for their valuable comments.

1. THE PAYOUT STRUCTURE

Essentially, an FTD is a CDS referencing more than one reference entity

An FTD swap protects the buyer of protection for the first default in a basket of credits. In a typical basket of 5-10 reference entities, each name has the same notional amount (USD 10m in the example in Chart 1). Since the FTD swap protects for the first default only, the swap contract has the same notional amount as that of a single reference entity (also USD 10m in the example). After the occurrence of the first credit event in the basket[1], the protection buyer delivers deliverable obligations[2] to the seller in exchange for par, just like in a single-name credit default swap ("CDS")[3]. The seller thereby suffers the loss of par minus the recovery value of the delivered obligation. The swap then terminates, and the seller is not subject to any further credit events beyond the first.

Chart 1: The FTD swap payout structure – an example



Source: BNP Paribas
RE: reference entity

The seller achieves leverage for an enhanced yield...

Like a CDS, an FTD swap is a credit play[4], without exposure to interest rate. Since the protection seller is exposed to any name that defaults first, he has effectively sold CDS protection on all the reference entities, but upon the first credit event, all the other CDS "knock out". He has therefore gained exposure to multiple credits, but has limited his potential loss to only one of them. The leverage he has thus taken on means that he is rewarded with a higher yield than the CDS premium of any one name in the basket (we discuss FTD pricing in Section 3). FTD is a very efficient tool for achieving enhanced yield via leverage.

...and the buyer achieves lower-cost (yet imperfect) hedging

On the other hand, the buyer has effectively bought protection with knockout features on all the names. The protection is therefore less than a perfect hedge, and the premium he pays on the FTD should be lower than the sum of the premiums on each of the credits[5]. With an FTD, he hedges a basket of credits against an unexpected blow-up at a lower cost than buying full protection on each of the names[6].

1 More specifically, this is the first time when the conditions to payment have been satisfied.

2 The buyer can deliver a portfolio of multiple deliverable obligations, the total notional amount of which is equal to the FTD notional.

3 Some FTDs have a standard CDS cash settlement procedure instead of physical delivery.

4 Counterparties also take a position in correlation, as explained in Section 3.

5 Theoretically, the FTD premium can be equal to the sum of the underlying CDS premiums in the case of zero correlation between each pair of reference entities. See Section 3 for details.

6 It should be mentioned that although this strategy hedges the first default risk, it does not specifically hedge the spread risk of the reference entities.

For a dealer who has bought FTD protection from, or sold protection to, an investor, it may be difficult to lay off his risk by taking an offsetting position with another investor or dealer, because of the tailor-made nature of many of these baskets[7]. In practice, a dealer hedges his credit exposure by taking offsetting positions of calculated delta amounts in the reference entities' single-name CDS, and continually rebalancing the deltas (we discuss delta-hedging in Section 4). This approach, however, only hedges an FTD's first-order exposure to spread movements. A dealer is still exposed to higher-order risks such as changes in correlation, spread convexity, instantaneous (sudden) default, recovery rates and consequences of time decay. He manages these by trading his correlation book.

A dealer delta-hedges his credit exposure and holds a position in correlation

FTD baskets trade in either swap form or in the form of credit-linked notes ("CLNs"). In an FTD CLN, the note proceeds are deposited in an account that collateralises the contingent payment obligations of the protection seller (the CLN buyer). Upon the occurrence of a credit event, the protection buyer gets paid par from the collateral account and delivers a deliverable obligation to the CLN buyer in lieu of CLN principal repayment. The CLN form is usually used for investors who prefer cash investments, who are restricted from trading swaps, or who have relatively high counterparty exposure to the dealer.

Besides FTDs, there are also trades in First-2-to-Default, or First-N-to-Default, which are usually for baskets of more than 10 names. For example, the First-2-to-Default covers the first two credit events in the basket. The notional of the trade is twice that of a single reference entity, and will reduce by half after settlement of the first credit event. In addition, there are also trades in Second-to-Default, or Nth-to-Default, although these are not as common as FTDs.

In fact, FTDs have gained so much popularity that dealers have begun to harmonise their documentation in order to develop a broader market for trading them. In response, the International Swaps and Derivatives Association ("ISDA") published a standardised FTD confirmation in July 2004[8]. This is expected to increase the volume, transparency and liquidity of FTD trades. In particular, it has facilitated dealers' offering of a menu of a commoditised baskets, as well as the trading of standardised FTD baskets between dealers and clients and amongst dealers (see Section 2).

The sector approaches maturity with documentation standardisation and trading of standardised baskets

7 However, this is becoming easier with standardised baskets traded between dealers and clients, as well as amongst dealers (see Section 2).

8 One of the issues that needs standardisation is the question of whether substitution of a reference entity or entities should be allowed in the event of a merger between the reference entities or between a reference entity and the protection seller, thereby effectively reducing the number of names in the basket. The ISDA FTD confirmation provides options as to whether substitution is applicable to the trade, and sets forth the mechanics for substitution if it is. In practice, most dealers use the "with substitution" language for trading standardised baskets.

2. COMMODITISED AND STANDARDISED BASKETS

Commoditised baskets trade alongside tailor-made ones

As the number of investors in FTDs increases, dealers have begun to offer a menu of “commoditised” baskets targeting a broad client base. These baskets are commoditised, as opposed to tailor-made for an individual investor, in the sense that they are composed to suit common investor demand and are traded with multiple clients. Dealers also commit more liquid secondary trading. Investors can now choose from these ready-made baskets or request tailor-made ones to suit their specific investment needs.

To enhance transparency and also to avoid adverse selection of the commoditised baskets, some trades are based on the constituents of public indices, such as CAC 40, Eurostoxx 50, FTSE 100 and S&P 100. Since these baskets contain a large number of names, the FTDs provide a greatly enhanced coupon. Obviously this comes at the expense of greater chances of a default in the baskets. Meanwhile, certain variations are created for investors who want exposure to only the better-quality names in the indices. This is done by applying certain filters to the index constituents, such as only the investment-grade names or only the liquid names, or both criteria, thereby reducing the number and risk of the reference entities in the baskets. Principal-protected structures can also be created, so that only the coupon is at risk to the FTDs (or First-N-to-Default) based on indices.

Eleven standardised baskets are traded in Europe

Another recent development has been the trading of standardised baskets in the dealer market, and also between dealers and investors. Following the creation of the Dow Jones iTraxx indices (“DJ iTraxx”) in June 2004, standardised FTD baskets have been formulated based on these indices. Each basket has 5 reference entities (except for the Diversified basket which has 7; see below), representing the most liquid names in the underlying index. Eleven standardised baskets are traded in Europe:

- eight industry baskets that are based on the DJ iTraxx Europe sector indices of the same names[9]: Autos, Energy, Industrials, TMT, Consumer Cyclicals, Consumer Non-Cyclicals, Financials Senior, and Financials Subordinated;
- a diversified basket of 7 entities, comprising the most liquid name in each of the above industry baskets (the two Financials baskets, having the same entities, contribute only 1 name here);
- a high-volatility (“Hi-Vol”) basket and a crossover basket, based on the DJ iTraxx Europe Hi-Vol index[10] and Crossover index[11], respectively.

9 These sector indices comprise the benchmark DJ iTraxx Europe index of 125 entities. Specifically, these sector indices have the following number of names: Autos 10, Energy 20, Industrials 20, TMT 20, Consumer Cyclicals 15, Consumer Non-Cyclicals 15, and Financials 25 (the same constituents for Financials Senior and Financials Subordinated). These are the most liquid European investment-grade names (excluding those rated Baa3/BBB- and on negative outlook), as determined by a dealer poll administered by the International Index Company.

10 The 30 names in the benchmark DJ iTraxx Europe index with the widest 5-year CDS referencing senior unsecured obligations.

11 The 30 European non-Financial names with a rating no better than Baa3/BBB- and on negative outlook, subject to certain spread restrictions, that are determined by a separate dealer poll administered by the International Index Company.

The 5 reference entities of each basket (except for the Diversified basket) are selected as follows:

- for each corresponding DJ iTraxx index, entities with no quoted spread, the 2 with the highest spreads and the 2 with the lowest spreads are removed;
- the 5 most liquid names of the remaining entities constitute the basket.
- The Financials Senior and Financials Subordinated baskets have the same constituents, based on the liquidity and spread of the subordinated issues (bank Lower Tier 2 debt). No more than 2 insurers are permitted.

Table 1 lists quotations of the standardised baskets, and Table 2 the basket constituents at the time of writing. The constituents will only change if, after a six-monthly roll of the DJ iTraxx indices, a basket reference entity is no longer in the relevant index, or has become one of the two widest or tightest names in the index. Such names will be replaced by the next most liquid eligible names. Apart from the above European baskets, there are separate ones of US names, based on the Dow Jones CDX North America indices.

Trading of standardised FTD baskets, and to a certain extent trading of commoditised baskets on a dealer's offering menu, has been a significant development, providing investors a number of benefits.

(1) *Transparency and liquidity:* this comes from the commoditisation of the baskets with standardised documentation, the commitment of dealers to provide liquidity and the liquid nature of the underlying reference entities. Liquidity of the baskets is evidenced by the relatively tight bid-offer spread, typically 5-7%[12] of the sum of spreads. We expect this spread to narrow further as trading volumes pick up. Obviously, liquidity comes at the expense of investors' control over name selection for the baskets.

(2) *Sector focus and leveraged exposure to liquid names:* the index-based baskets ensure that investors gain leveraged exposure to the most liquid names. They also allow investors to focus on particular industry sectors, or other segments of the credit market, such as higher-yielding names, through the Hi-Vol and Crossover baskets. This sector focus enables investors to apply their industry-specific expertise. Obviously, it comes at the expense of increased correlation within the baskets (except for the Diversified basket).

FTDs can now be used as long-term investments or for short-term trading

(3) *Trading on shorter-term views:* fundamentally, the FTD sector has changed from buy-and-hold only, to one that encompasses both customised trades for specific long-term investments and commoditised baskets that allow investors to express their shorter-term views on credit and correlation. Typically, credit views are implemented by taking an outright long or short position in the FTD, and correlation views by taking delta-hedged positions (see Section 4). In practice, fundamental credit investors such as banks and funds tend to use baskets for expressing credit views, whereas unconventional investors such as hedge funds tend to take correlation positions in the baskets by exchanging deltas with dealers (e.g., selling protection on an FTD and buying protection from the dealer on the underlying CDS. See Section 4 for details).

[12] The bid-offer for Financials baskets is usually wider, due to the uncertainty of correlation within the industry (we discuss the role of correlation in pricing in Section 3).

Table 1: Quotations of standardised FTD baskets

FTD Baskets	Bid / Offer*	SoS Mid (bp)	Bid (bp)	Offer (bp)
Autos	76% / 83%	195	148	161
Energy	81% / 88%	151	122	132
Industrials	82% / 89%	177	145	157
TMT	78% / 83%	193	150	160
Consumer Non-cyclicals	81% / 88%	213	172	187
Consumer Cyclicals	73% / 80%	288	210	230
Financials Senior	69% / 79%	88	60	69
Financials Subordinated	70% / 80%	144	100	115
Crossover	75% / 80%	706	529	564
Hi-Vol	79% / 86%	333	263	286
Diversified	82% / 87%	301	246	261

Source: BNP Paribas, 04 October, 2004
*As a percentage of the sum of spreads in the next column.
SoS: Sum of spreads (CDS premiums) of the underlying entities (see Section 3 for FTD pricing).
All prices are for discussion purposes only, on a basis of exchanging deltas with clients, for trades in a swap form, with a size of EUR 10m and a maturity of 20 December, 2009.

Table 2: Compositions of standardised FTD baskets

Ticker	Name	Ticker	Name
Autos		**Energy**	
CONTI	Continental AG	ELESM	Endesa SA
PEUGOT	Peugeot SA	LYOE	Suez
RENAUL	Renault	REP	Repsol YPF SA
VLOF	Valeo	RWE	RWE AG
VW	Volkswagen AG	VIEFP	Veolia Environment
Industrials		**TMT**	
BAPLC	BAE Systems plc	BRITEL	British Telecommunications plc
BYIF	Bayer AG	DT	Deutsche Telekom AG
LAFCP	Lafarge	FRTEL	France Telecom
ROLLS	Rolls-Royce plc	TELEFO	Telefonica SA
STGOBN	Compagnie de Saint-Gobain	VOD	Vodafone Group plc
Consumer Cyclicals		**Consumer Non-Cyclicals**	
ACCOR	Accor	ALYON	Allied Domecq plc
EXHO	Sodexho Alliance	CARR	Carrefour
HGLN	Hilton Group plc	GROUPE	Casino Guichard-Perrachon
LUFTHA	Deutsche Lufthansa AG	IMPTOB	Imperial Tobacco Group plc
MOET	LVMH Moet Hennessy Louis Vuitton	METFNL	Metro AG
Financials Senior		**Financials Subordinated**	
ABBEY	Abbey National plc	ABBEY	Abbey National plc
ALZ	Allianz AG	ALZ	Allianz AG
AXASA	AXA	AXASA	AXA
CMZB	Commerzbank AG	CMZB	Commerzbank AG
HVB	Bayerische Hypo- und Vereinsbank AG	HVB	Bayerische Hypo- und Vereinsbank AG
Hi-Vol		**Crossover**	
BATSLN	British American Tobacco plc	ABB	ABB International Finance Limited
DCX	DaimlerChrysler AG	AHOLD	Koninklijke Ahold NV
FRTEL	France Telecom	ALAFP	Alcatel
LUFTHA	Deutsche Lufthansa AG	EMI	EMI Group plc
VW	Volkswagen AG	METSO	Metso Oyj
Diversified		**Sector**	
VW	Volkswagen AG	Autos	
ACCOR	Accor	Consumer-Cyclicals	
METFNL	Metro AG	Consumer Non-Cyclicals	
LYOE	Suez	Energy	
HVB	Bayerische Hypo- und Vereinsbank AG	Financials	
BYIF	Bayer AG	Industrials	
FRTEL	France Telecom	TMT	

Source: International Index Company, 20 September, 2004

3. FTD PRICING

Although an FTD's structure is straightforward, its pricing is not and involves quantitative modelling. Intuitively, an FTD's premium should be higher than the CDS premium of any reference entity, because the seller has multiple credit exposures. On the other hand, it should be lower than the sum of all CDS premiums, because the seller is subject to the potential credit loss of only one of them (we discuss FTD pricing boundaries later in this section). FTD pricing therefore depends on the underlying CDS premiums but also other factors. We examine the pricing parameters in this section.

Like pricing a single-name CDS[13], pricing an FTD swap means finding the premium level that equates the present values ("PVs"), in absolute terms, of the basket swap's premium leg and default leg. The FTD premium is paid until the earlier of the first credit event and trade maturity, and the protection payment of 1 – Recovery is contingent on the first credit event occurring before maturity. Since both legs have uncertain cash flows, their PVs are calculated with default probabilities[14].

Again, as is the case when pricing an off-market CDS, each basket reference entity's term structure of default probabilities is inferred from its CDS curve, with the help of a recovery assumption. The default probability of the basket, i.e., that of the first default, however, also depends on the joint behaviour of defaults between the names. The pricing model must address this joint behaviour.

FTD pricing involves more parameters than pricing a single-name CDS ...

The inputs to an FTD swap pricing model include[15]:

- the number of reference entities;
- the default probability and recovery assumption of each reference entity[16];
- the correlation between the reference entities; and
- trade maturity.

...the key component of which is correlation

Clearly, one parameter that does not appear in pricing single-name CDS is the correlation between reference entities. Correlation, however, is a key driver in pricing portfolio products such as FTDs and CDOs. For this reason, these products are broadly labelled "correlation products".

13 See *Understanding Credit Derivatives Volume 4: CDS Pricing.*

14 We use the words "default" and "credit event" interchangeably in this report, although they have different definitions (see *Understanding Credit Derivatives Volume 2: CDS Basics* for details).

15 Pricing should also take into account the protection seller's counterparty credit risk in terms of its default probability and correlation with the reference entities. However, this risk element is usually dealt with by collateral arrangements or similar agreements with the counterparty.

16 For emerging market baskets, the model also accounts for the sovereigns' default probabilities.

Default correlation

Default correlation or asset correlation?

Before we start discussing correlation, it is important to mention the difference between two correlation measures: default correlation and asset correlation. Although default correlation is the measure that we wish to know, in reality it is difficult to obtain reliable statistics on it due to a lack of empirical data. For modelling purposes, practitioners instead use asset correlation, proxied by the correlation of equity returns, in deriving simulations of correlated default distributions. We discuss the difference between these two measures in greater detail in the next sub-section. But here we start with a theoretical discussion on default correlation itself in order to show why correlation matters in pricing FTDs.

Correlation helps define a portfolio's default frequency distribution

Default correlation is a portfolio measure that assesses the tendency for reference entities to default together. For example, suppose an investor owns a portfolio of 10 credits, each having a default probability of 10% over the holding period. Although he knows the riskiness of each name, without a correlation measure, he will still be in the dark regarding the riskiness of the portfolio, i.e., the probability of zero defaults, 1 default, 2 defaults, ... , to 10 defaults. Default correlation helps answer this question. Together with each entity's default probability and recovery assumption, default correlation helps define the expected portfolio loss distribution, enabling an investor to calculate the economic capital needed to support a portfolio investment.

The following scenarios help illustrate the role of correlation in defining the portfolio default distribution (Chart 2).

(1) When default correlation between each pair of names is at its most positive theoretical point of 100%, if one defaults, others always default with it; and vice versa if one survives. By definition, all entities will behave like one, having the same default probability and defaulting at the same time. In our hypothetical case, this means that there is a 90% chance that all survive, a 10% chance that all default, and nothing in between. These extreme potential outcomes make the portfolio the most risky for the investor.

(2) With a zero pair-wise correlation, each default occurs regardless of the survival of others. Defaults in the portfolio therefore follow a binomial process[17]. In this case, there are high chances of 0 defaults, 1 default and 2 defaults.

[17] In a binomial distribution, the probability of having x defaults out of n names, each having a probability of p, is given by:

$$b(x,n,p)=\binom{n}{x}p^{x}\,(1-p)^{n-x}$$

where:

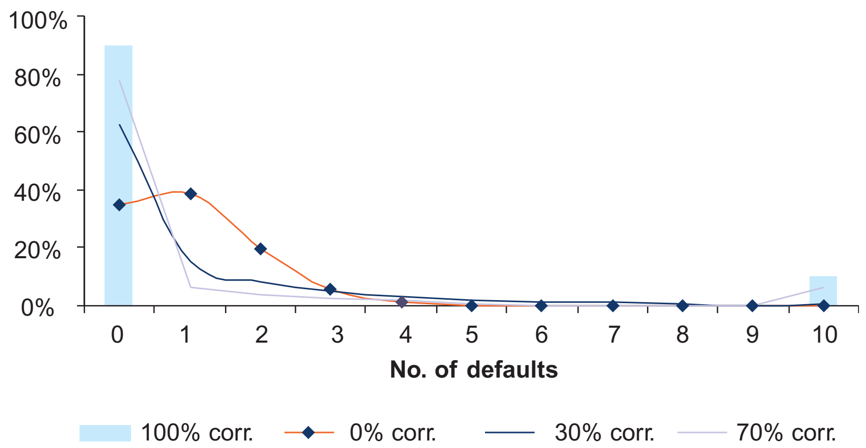
$$\binom{n}{x}$$

is the combination of x out of n.

(3) With a 30% pair-wise correlation[18], if one defaults there is a 30% chance that another will default with it. Compared to 0% correlation, there are increased chances of a large number of defaults, as shown in Chart 2 by the fatter tail of the distribution for 4 or more defaults, including the non-zero chance of 10 defaults. On the other hand, it also means that if one survives, there are increased chances of others surviving as well, thereby increasing the probability of 0 defaults. Correspondingly, the probabilities of 1-3 defaults are lower.

(4) As we continue to raise the correlation to 70%, the probabilities move further into the extreme events of 0 default and 10 defaults, making the distribution more like that for a perfect positive correlation of 100%.

Chart 2: Portfolio default frequencies



Source: BNP Paribas

Here we forego a discussion of negative pair-wise correlations, because the relationship gets complex with a large number of entities[19]. Anyway, in practice it is far more common to have a positive correlation between entities than a negative one[20]. *For this reason, we will assume that correlation ranges between 0 and 1 for further discussions*.

The effect of correlation: higher correlations reduce the risk in an FTD trade

As shown in Chart 2, positive correlations increase the chance of no default and correspondingly reduce the chance of one or more defaults. Since an FTD terminates at the incidence of the first default, regardless of whether there will be subsequent defaults (i.e., regardless of the total number of defaults), the probability of no defaults, or its reverse: of *any* defaults, is paramount to FTD pricing. Positive correlations therefore reduce the risk of an FTD trade. As a result, higher correlations reduce an FTD's fair premium, as shown in detail later in this section.

18 We also assume that the conditional correlation between any two assets is constant regardless of the number of assets that have already defaulted. This helps define the joint default distribution. *See Moody's Correlated Binomial Default Distribution*, Moody's, August 2004.

19 For example, a perfect negative correlation of –100% may well exist between two names A and B, i.e., when A defaults B survives, and vice versa. But it is impossible to have the same pair-wise relationship between three names A, B and C, because by definition, if A defaults, B and C should survive. But now that both B and C survive, they don't have the assumed perfect negative correlation any more.

20 It is theoretically possible to have a negative correlation between competitors, as one's failure may reduce the level of competition and improve another's chance of survival. That said, competitors in one industry are subject to common industry dynamics, typically resulting in a positive correlation.

From asset correlation to default correlation

Discrete default correlation has its limitations...

The key to pricing a correlation product is to generate a joint distribution of defaults for a given correlation, such as those in Chart 2. We discussed the role of default correlation in the previous sub-section. In reality, default correlation statistics are hard to come by, due to the sparseness of actual defaults. In addition, taking each default event as one discrete data point in calculating default correlation has its limitations: it does not shed light on the process that causes default, and throws away a lot of useful information, such as a time series of the entity's asset value changes before default. In other words, correlation based on discrete default events does not make use of an economic structure that will help analyse the probability of correlated defaults in the future.

...so asset correlation is used in modelling

This means that we need to turn to other correlation measures in modelling correlated defaults. Asset correlation, as proxied by equity correlation, has become practitioners' common choice. Equity prices are transparent, abundant, and usually available for long enough periods of time for calculating correlations. In addition, asset returns, again as proxied by equity returns, can be used in the well-established Merton-type structural models to simulate the default process, where default happens when asset value falls below a certain threshold, i.e., the level of debt.

With asset returns generating hypothetical defaults, asset return correlations generate the required distribution of correlated defaults. In terms of implementation of pricing correlation products, the default threshold of each entity is calibrated to its CDS curve, giving an individual, or marginal default distribution[21]. These marginal distributions are linked into one joint distribution for the portfolio via a dependence structure of asset returns that uses a Gaussian copula[22]. Monte Carlo simulation is usually used for generating the joint default distribution[23]. Simulation is especially important for FTD pricing, because FTDs are essentially an idiosyncratic product in the sense that the identity of the first default must be simulated for hedging purposes.

As is the market norm, correlation used in the rest of the report refers to asset correlation.

21 An alternative, used by rating agencies, is to use historical default probabilities by rating, rather than those implied from market prices.

22 For a credit portfolio, a copula function aggregates multiple single-name survival curves to one multi-name survival curve. Gaussian copula has become the market standard for modelling correlation products, due to its analytical tractability and the small number of parameters required.

23 One recent development has been the use of a semi-analytical dependence framework, which combines a Gaussian copula with a latent-factor dependence structure. It allows faster calculations of deltas as well as other risk management parameters of a dealer's correlation book. See Laurent & Gregory (2003).

Correlation's effect on FTD pricing through delta-hedging

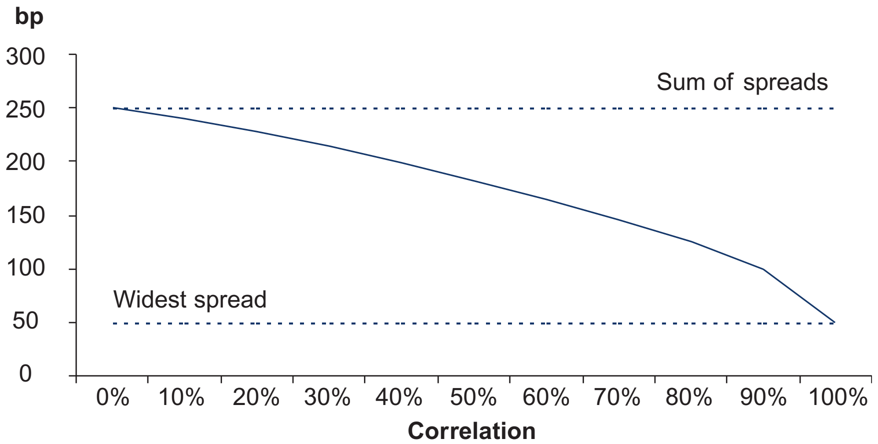
The FTD protection seller is long correlation

As we know, an increase in correlation increases the probability of no default in the basket, thereby reducing the risk of an FTD trade. The protection seller, i.e., the investor who is long credit risk, is therefore also long correlation. Other things being equal, he gains from a rise in correlation and loses if it falls. Selling protection on an FTD basket is therefore not only taking a credit exposure to the underlying reference entities, but also taking a long correlation position in the hope that the correlation level will increase.

An FTD's fair premium decreases with an increase in correlation

Accordingly, the fair price of an FTD decreases with an increase in correlation (Chart 3). This means that when the fair premium falls below the contract premium, the protection seller has a mark-to-market ("MTM") gain[24]. Furthermore, other things being equal, an FTD's premium is highest when reference entities are uncorrelated, and lowest when they are perfectly correlated (we discuss FTD pricing boundaries in the next sub-section).

Chart 3: FTD premium's sensitivity to correlation



Source: BNP Paribas

Assumptions: 5 reference entities with a uniform spread of 50bp, a flat CDS curve, and a recovery assumption of 40%, in a 5-year FTD trade.

If the above discussions on the relationship between correlation and FTD premium seem a bit theoretical, we illustrate below how correlation affects FTD pricing in practice, that is, through a dealer's underlying hedging process. We briefly introduce delta-hedging here, and will return for a more detailed discussion in Section 4.

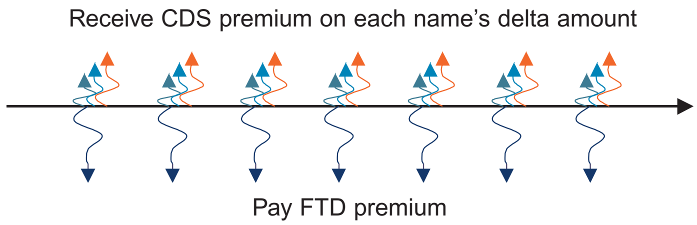
A dealer delta-hedges an FTD trade, where the delta amounts affect the FTD premium

Correlation products such as FTD swaps cannot be replicated by taking a static position in the underlying CDS or cash bonds. Their risk-return profile can only be addressed through a dynamic hedging process known as delta-hedging. When a dealer buys FTD protection from an investor, he offsets this short position on credit by selling protection on each reference entity in the basket (Chart 4). The notional amount of the hedge is only a fraction (i.e., the delta) of the notional amount of the reference entity, and the delta for each name may not be the same, depending on the risk characteristics of the portfolio. Also, the deltas do not remain static after initiation of the trade; rather, they are rebalanced as a number of parameters change, amongst which are changes in the underlying spreads, correlation and time to maturity (we discuss these in more detail later).

24 Marking-to-market an FTD is the same in principle as CDS MTM, which is discussed in *Understanding Credit Derivatives Volume Four: CDS Pricing.*

Before we come to how the deltas are set, it is useful to know that the higher the deltas, the more premium income a dealer receives from the hedge, therefore the higher the FTD premium that a dealer is able to pay the investor.

Chart 4: A simplified example of a dealer's delta-hedging



Source: BNP Paribas
Assuming no defaults. This is a simplified example, as the deltas are not adjusted through time.

Correlation affects the potential unwind costs of the hedges...

When setting the deltas, a dealer needs to bear in mind the correlation level between the reference entities. This is because an FTD trade will terminate upon the occurrence of the first default, thereby obliging the dealer to unwind all the hedges, including the ones on the performing credits. Correlation plays a part here because it will affect the unwind costs. In the case of high correlation, when one defaults, there is a high chance that others will default as well. This will be reflected in higher CDS premiums for the surviving credits, resulting in higher unwind costs when the dealer buys back protection on his hedges. By the same token, unwind costs will be lower in the case of low correlation.

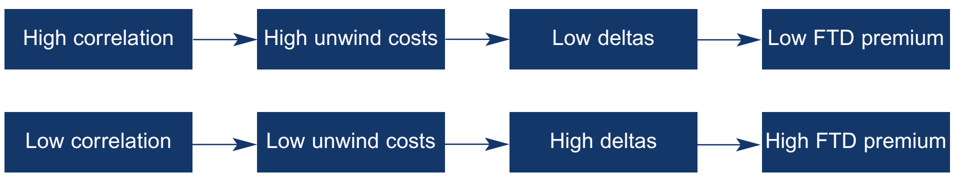
...which in turn affects the setting of the deltas in the first place...

Apart from unwind costs on the surviving credits, a dealer will typically have an unwind gain on the defaulted name. This is because he has protection on this name from the FTD to the full notional amount, but has sold protection on the name for only the amount of the hedge. This mismatch will result in a gain for the dealer when one entity suddenly defaults[25]. He will use this gain to offset the unwind costs on the surviving credits. Since unwind costs will be higher for high correlation, the dealer must keep deltas low in order for the offset to work. And vice versa if correlation is low. Obviously, all this is accounted for by the pricing model, and the above hedging behaviour reflects a model's outputs.

...and the FTD premium

As pointed out above, other things being equal, when deltas are low the FTD premium is low, and vice versa. This is how correlation affects the FTD premium through the hedging process, as summarised in Chart 5.

Chart 5: Correlation's effect on FTD pricing through delta-hedging



Source: BNP Paribas

25 For example, given an FTD notional of $10m, a delta of 80% for the defaulted name, and a recovery rate of 40%, the dealer gets paid $6m net (= $10m * (1 – 40%)) from the FTD, but pays only $4.8m net (= $10m * 80% * (1 – 40%)) to his hedging counterparty on this name, resulting in a gain of $1.2m.

FTD pricing boundaries

Now that we know the underlying hedging process and the effect of correlation on pricing, we revisit the boundary conditions for FTD premiums (Chart 3 in the previous sub-section). When the reference entities are uncorrelated, one's default will not affect others' survival or their CDS premiums, and therefore will not affect the dealer's potential unwind cost. This enables the dealer to sell protection on each name to the full notional amount, i.e., to a delta of 1 for all. Upon the first default, the dealer will offset his position on the defaulted name by squaring the protection bought from the FTD with the protection sold in the hedge. He will also unwind the hedges on the other names at no additional cost.

The upper bound: the sum of spreads

The dealer's income from the hedge is therefore the sum of all entities' CDS premiums, which becomes the theoretical fair premium of the FTD given zero correlation . The upper pricing bound for an FTD, assuming zero correlation[26], is therefore the sum of the spreads of the reference entities. For an investor who sells FTD protection, he effectively gains full credit exposure to each name through the FTD, while limiting his potential loss to one entity only. The FTD trade provides him the highest leverage and yield enhancement.

At the other extreme where defaults are perfectly correlated, if one defaults, others default too. Since an FTD trade only covers the dealer for one default, he can only sell protection on one name for hedging, otherwise the simultaneous multiple defaults would cause him a severe loss. Nevertheless, for the one name that he chooses to sell protection on, he can sell to the full notional amount of the FTD trade, i.e., to a delta of 1. And he chooses the widest-spread name to hedge in the hope of matching the identity of the first entity to default[27].

The lower bound: the widest spread

The lower pricing bound for an FTD, assuming perfect correlation, is therefore the widest spread of the reference entities. For an investor who sells FTD protection, he effectively gains full credit exposure to only one name through the FTD, similar to selling a single-name CDS. The FTD does not provide him any leverage or yield enhancement.

In practice, deltas are between 0 and 1 for each name

In practice, correlation is normally between 0 and 1, the deltas for the reference entities also between 0 and 1, and the FTD premium between the widest spread and the sum of spreads. The investor therefore gains credit exposure to multiple names through the FTD trade, but his effective exposure to each name is less than the full notional amount. Since the total delta amount[28] is higher than an FTD's notional, an FTD trade provides investors leverage.

An FTD's quotation usually makes reference to the theoretical boundaries. For example, depending on a deal's particulars, an FTD may be offered at 85% the sum of spreads (294bp), translating to 250bp. Deal statistics may also refer to the lower boundary, e.g., 2.5 times the widest (100bp).

26 This is not to say, however, that FTD premium is always equal to the sum of the CDS premiums times their respective deltas, although this is the case for extreme correlations of 0 and 1. For correlations in between, FTD premium is typically higher than this sum, due to spread gamma and the instantaneous default risk, as discussed in Section 4.

27 That said, in this theoretical case, spreads are most likely the same for all reference entities, as they have the same default risk. If this is true, the dealer can choose any of the names to sell protection on.

28 Which is the sum of the deltas times the notional amount of the FTD.

Other pricing parameters

The number of names and their spreads affect basket pricing...

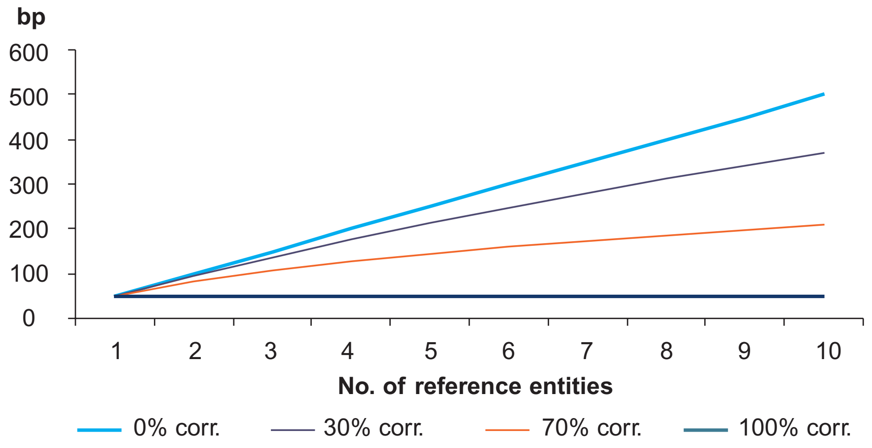
In addition to correlation, the number of reference entities in the basket and their spread levels also play a key part in FTD pricing[29]. Other things being equal, more reference entities mean more credit exposure and higher leverage for the protection seller, therefore a higher FTD premium (Chart 6).

...but their effects depend on correlation

It is worth noting that, barring the boundary cases, as more names are added to the basket, their marginal impact on increasing the FTD premium decline, as shown by the curves' decreasing speed of increase for 30% and 70% correlations. This is particularly the case for high correlations, which significantly reduce the effective credit exposure and leverage of the basket.

In other words, adding highly correlated names to a basket does not help enhance yield greatly. In our hypothetical example in Chart 6, having 5 names with a 30% pair-wise correlation yields (213bp) even slightly more than having 10 names with a 70% correlation (209bp). In the extreme case where reference entities are perfectly correlated, the basket premium depends on the widest spread, not on the number of names at all, as shown by the flat line in Chart 6. At the other extreme, adding uncorrelated names does the most to enhance yield, as shown by the straight diagonal line in the chart.

Chart 6: FTD premium's sensitivity to the number of reference entities



Source: BNP Paribas

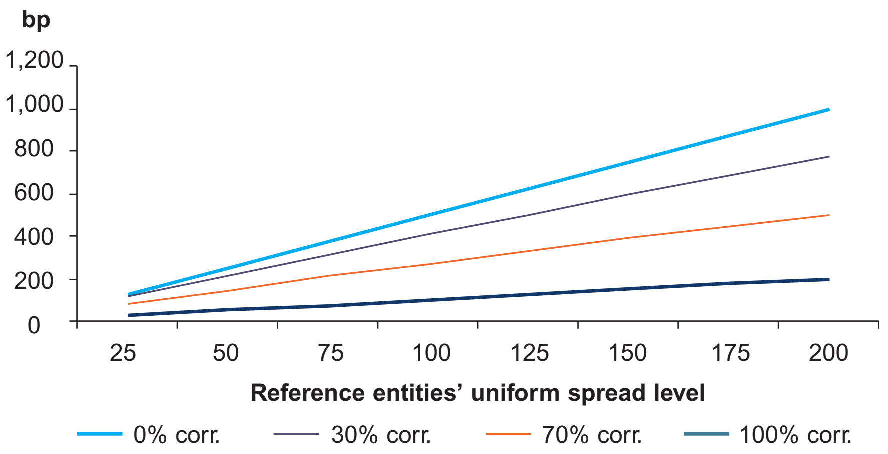
Assumptions: All names have a spread of 50bp, a flat CDS curve and a recovery assumption of 40%, in a 5-year FTD trade.

Obviously, other things being equal, the FTD premium also increases with the reference entities' spread levels (Chart 7). Again, correlation plays a part here, so that a basket of highly correlated names with wide spreads may not necessarily produce a higher FTD premium. In the hypothetical example in Chart 7, the 5 names with a uniform spread of 75bp and a 70% correlation in fact have a slightly lower FTD premium (209bp) than the 5 names with a uniform spread of 50bp and a 30% correlation (214bp).

29 For simplicity, we ignore the protection seller's default probability and its correlation with the reference entities. Where this counterparty risk is significant, i.e., where the protection seller is of low credit quality and/or has high correlation with the underlying names, a common solution is to structure the FTD in the form of a CLN, so that the seller's contingent protection payment obligations, as well as the trade's MTM, are collateralised by the note proceeds.

We also forego an analysis of the trade maturity's effect on FTD pricing, as this depends on the shape of the underlying CDS curves. The market norm is a 5-year tenor anyway.

Chart 7: FTD premium's sensitivity to spread levels



Source: BNP Paribas

Assumptions: 5 reference entities with a uniform spread level shown on the horizontal axis, a flat CDS curve and a recovery assumption of 40%, in a 5-year FTD trade.

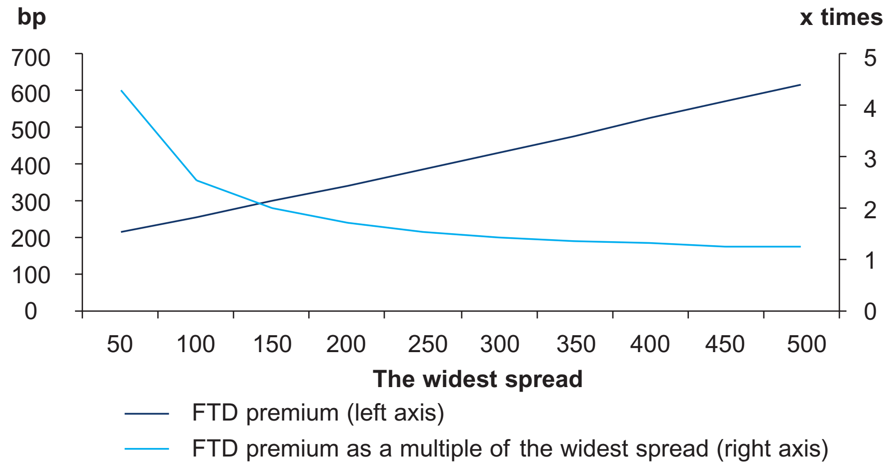
The widest spread has a large impact on FTD pricing

In a typical basket where the underlying spreads are not uniform, the widest spread has the largest impact on the FTD premium, other things being equal. Chart 8 shows the widest spread on the horizontal axis, with the other spreads being fixed at a uniform level of 50bp. The upward-sloping line indicates that adding a wider-spread name increases the FTD premium.

As we move to the right along the horizontal axis, this widest spread exceeds the rest by an increasing margin and begins to dominate the basket, making it the obvious favourite to default first. This means that the basket's risk is heavily concentrated in this one name. The FTD becomes less of a basket and more of a single-name CDS on this widest name. In the accompanying hedging process, the delta for the widest name rises toward 1 and the deltas of others fall toward 0 (we discuss delta hedging in Section 4). This is evidenced by the downward-sloping line that shows the FTD premium as a multiple of the widest spread. As this multiple drops close to 1, the widest-spread name represents most of the credit exposure in the basket, while others contribute little to the FTD premium.

Adding a name whose spread is significantly above the levels of the rest therefore negates the rationale of investing in an FTD basket, i.e., to gain leverage and enhance yield. It is consequently not an ideal basket to have one high yield name in an otherwise investment-grade basket.

Chart 8: FTD premium's sensitivity to the widest spread



Source: BNP Paribas

Assumptions: 5 reference entities, 4 having a uniform spread of 50bp and the remaining one having a spread as shown on the horizontal axis; a 30% correlation, a flat CDS curve, a recovery assumption of 40% and a 5-year maturity.

FTD pricing is insensitive to recovery assumptions

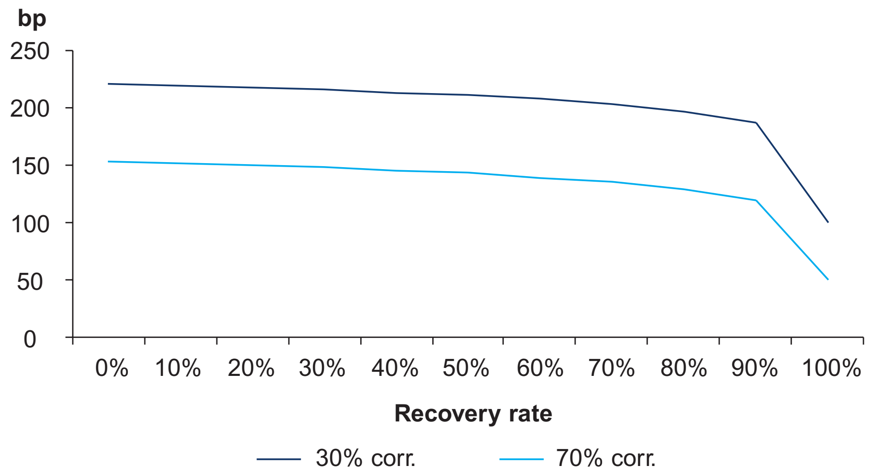
The above analyses have all used a 40% recovery assumption. A protection seller is obviously long recovery value given default, as a higher realised recovery means less loss in settlement. However, this is post-credit event; on the trade date, the recovery assumption does not affect the fair value of an FTD significantly. This is because, given a spread level for the reference entity, a higher recovery assumption (lower risk to the seller) implies higher default probabilities (higher risk to the seller). The two opposing effects largely cancel out each other, leaving the fair FTD premium rather insensitive to the recovery assumption (Chart 9). A higher assumption results in a slightly lower FTD premium.

Note that the FTD premium falls sharply toward zero when the recovery assumption is close to 100%. This is because there will be little loss given default, making the trade payoff insensitive to defaults.

Also note that the above discussions are regarding the fair market premium. For marking to market an existing FTD (e.g., a trade with a contract premium of 200bp and a current fair premium of 180bp), the recovery assumption matters because it changes the default probability of the basket, hence the value of the annuity cash flow. This is similar to CDS MTM[30].

[30] See *Understanding Credit Derivatives Volume 4: CDS Pricing.*

Chart 9: FTD premium's insensitivity to the recovery assumptions



Source: BNP Paribas

Assumptions: 5 reference entities with a uniform spread of 50bp and a flat CDS curve, in a 5-year FTD trade.

The formula for constructing an ideal FTD basket

Having discussed the effects of various parameters on FTD pricing, it is easy to see what makes an ideal basket for gaining leverage and enhancing yield. It should comprise of:

- investment-grade entities, typically 3-10 names if liquidity is required of the trade but can be as many as 100 names for buy-and-hold investments offering higher yields;
- at fairly similar spread levels;
- with relatively low pair-wise correlations;
- and a low correlation with the FTD protection seller (otherwise structure the FTD in the form of a CLN); and
- with a 2-10 year maturity (5-year being the most liquid).

4. HEDGING AND DELTA-HEDGED FTD TRADES

Delta-hedged positions provide a "purer" exposure to correlation

Although delta-hedging has always been part of FTD trades from the dealers' point of view, this has not always been the case for credit investors, who tend to take outright positions and use FTDs to gain leveraged credit exposure and to express their credit views. This, however, is changing. With real-money investors becoming more sophisticated in their investment strategies, coupled with the participation of hedge funds, dealers are executing an increasing number of trades on the basis of "exchanging deltas" with clients. For example, an investor selling protection on an FTD also buys protection from the dealer on the underlying reference entities according to their deltas. Investors typically achieve the following from these delta-hedged positions.

(1) *Reducing credit exposure in the trade:* the credit exposure levered up in the FTD is then de-levered with offsetting positions of delta amounts in the underlying CDS. This reduces the net exposure to the entity that defaults first. It also immunises the FTD's MTM value from small movements in the underlying CDS premiums (see the next sub-section for details). The hedge thereby reduces the magnitude of the credit element in the trade, although it does not totally remove all credit exposures (partly because it is not common for an investor to dynamically rebalance the deltas, so that there will be a net exposure to the first default because its delta is less than 1).

(2) *Maintaining a position in correlation:* with reduced exposure to credit, the investor is left with a "purer" position in correlation. Combining a correlation product with a delta portfolio of plain vanilla CDS does not change the correlation characteristics. For example, selling delta-hedged FTD protection is still a long correlation position. If realised correlation is weak and there turns out to be one default only, the investor loses because he has sold protection on the first default to the full notional amount, but has bought protection on the name for only the delta amount, leaving him a positive net exposure to the first deafult. If, however, correlation turns out to be strong and there is a second default, the investor gains from the protection bought in the CDS, whereas he is not liable to the second default in the FTD. Even without any defaults, if an investor marks-to-market this trade, he gains from a strong realised spread correlation (i.e., if spreads widen or tighten together), and loses from a weak realised correlation (e.g., if one spread blows out). See discussions on gamma in this section for details.

(3) *Earning a positive carry:* when selling delta-hedged FTD protection, an investor typically earns a positive carry, which means a negative carry for the counterparty, i.e., the dealer. This is because a dealer can expect to recapture the lost carry in its dynamic delta-hedging, benefiting from both the individual spread gamma and the potential sudden default (detailed discussion later in this section).

Selling delta-hedged FTD protection is therefore a way to express a correlation view while earning a positive carry. This turns out to be a popular trade with hedge funds when market conditions are right. One thing to note is that trades with an exchange of deltas typically attract better prices from dealers, as they can be structured with mid CDS levels, avoiding the bid-offer spread. This is because the dealer effectively buys protection from the FTD and sells protection in the CDS back to the investor.

In the following, we discuss the key elements in delta-hedging to help illustrate how these trades are structured. This part is also relevant for real-money investors taking outright FTD positions, because deltas help define the amount of credit exposure to each entity in the trade.

Deltas

Deltas hedge an FTD's first-order exposure to spread changes...

A reference entity's delta represents the percentage of its notional amount that a hedger sells/buys in CDS to hedge his short/long position in the basket trade[31]. His motivation in doing so is to hedge the MTM changes of the FTD due to small spread movements of the underlying credits.

For a dealer who has bought FTD protection and sold deltas, a spread tightening means a decrease of the FTD's fair premium, hence a negative MTM. On the other hand, he will have a positive MTM on the CDS. In order for the two opposite MTMs to offset each other, delta represents the ratio between the two (in absolute terms, since they have opposite signs):

Delta = Change in FTD MTM / Change in CDS MTM

In other words, given a 1bp change in a reference entity's CDS, the resulting change in CDS MTM times the delta equals the change in FTD MTM. With the two values having opposite signs, a dealer is hedged against MTM volatility caused by relatively small spread movements.

For example, the widest name in Chart 10 has a spread of 70bp. For a $10m notional, a 1bp tightening would translate into a CDS MTM change of $3,344. It would also cause the FTD MTM to change by $2,458, given a 30% correlation between reference entities. The delta is therefore 73.5% (= 2,458 / 3,344).

Deltas are often calculated by brute force[32], i.e., by "bumping" the reference entity's credit curve by a small amount (1-10bp) and then calculate the changes in the relevant MTMs. Deltas are typically positive but less than 1 (i.e., in the range of 0-100%). This means that each reference entity represents an exposure in the basket, but the basket's risk is diversified across the names rather than concentrated in any one.

It is worth noting that delta hedging only works for small changes in spreads. For large changes, there is also a convexity factor that affects the MTM values, making the hedge imperfect[33]. A dealer therefore re-adjusts deltas periodically, making delta-hedging a dynamic process.

...but there are also higher-order risks

Delta-hedging tackles the spread risk, which is the first-order risk of the trade and a dealer's main concern. Beyond deltas, a dealer is also subject to higher-order risks such as spread convexity, changes in correlation, instantaneous (sudden) default, recovery rates and time decay. These risks are also aggregated and hedged in a dealer's correlation book.

31 A dealer is short in the trade if he has bought FTD protection from the investor.

32 Although a recent development has been using a semi-analytical approach in calculating deltas and other risk management parameters. See Laurent & Gregory (2003).

33 An FTD's gamma to an individual spread is larger than that of the CDS. We discuss gamma later in this section.

Delta sensitivities

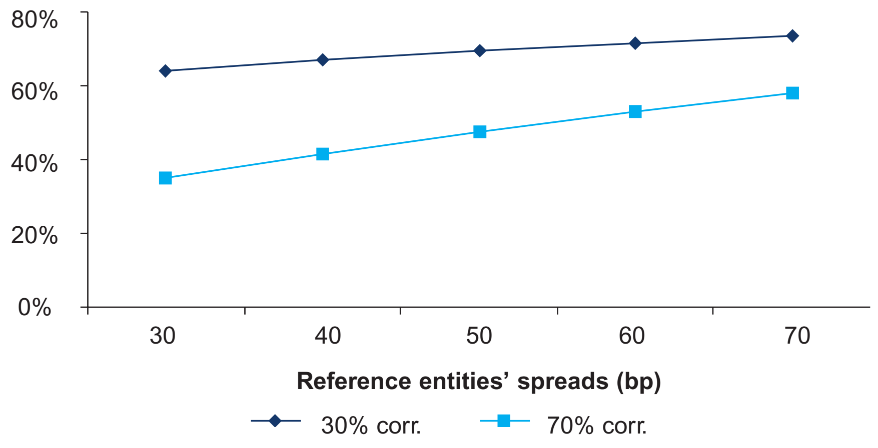
As deltas hedge the spread risk, they are foremost determined by spread levels. Chart 10 shows that, given a correlation level, a higher spread means a higher delta. This is because, given a uniform recovery assumption for all reference entities, a higher spread indicates a higher default probability, or a shorter survival time. The widest name is therefore expected to default first, thereby posing the highest risk to the FTD trade. Hence the highest delta. Vice versa for the tightest name.

The higher an entity's spread, the higher its delta

Deltas are also affected by correlation levels. Chart 10 shows that higher correlation results in lower deltas. This is because higher correlation increases the chances of multiple defaults but also the probability of no default, thereby decreasing the risk of an FTD. Hence lower deltas for all names. Note that for a higher correlation, the delta curve is steeper, i.e., the differences between deltas are bigger. This is because, as discussed in Section 3, high correlation implies potentially high unwind costs on the surviving names (expected to be those with lower spreads), therefore their deltas need to be low.

Higher correlation means lower deltas

Chart 10: Delta sensitivity to spreads and correlation



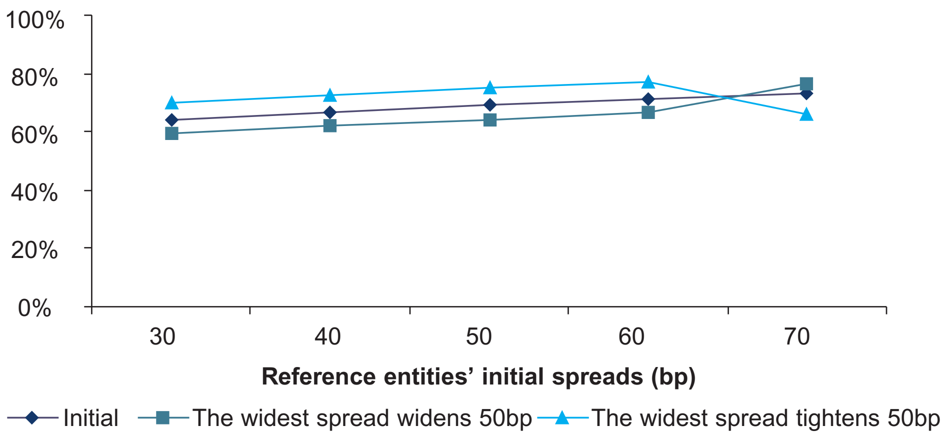
Source: BNP Paribas

Assumptions: 5 reference entities with respective spread levels shown on the horizontal axis, flat credit curves, a uniform recovery assumption of 40%, in a 5-year FTD trade.

As we know, changes in spreads necessitate re-balancing deltas, where a hedger sells extra CDS protection, or buys back part of it. If one spread widens while others remain constant, it moves forward in the "default time" queue, thereby representing a higher risk to the FTD. Hence its delta increases. Correspondingly, deltas of others drop, due to their reduced risk relative to the widened name. Vice versa if one name tightens (Chart 11).

An individual spread widening increases its delta...

Chart 11: Delta sensitivity to an individual spread change



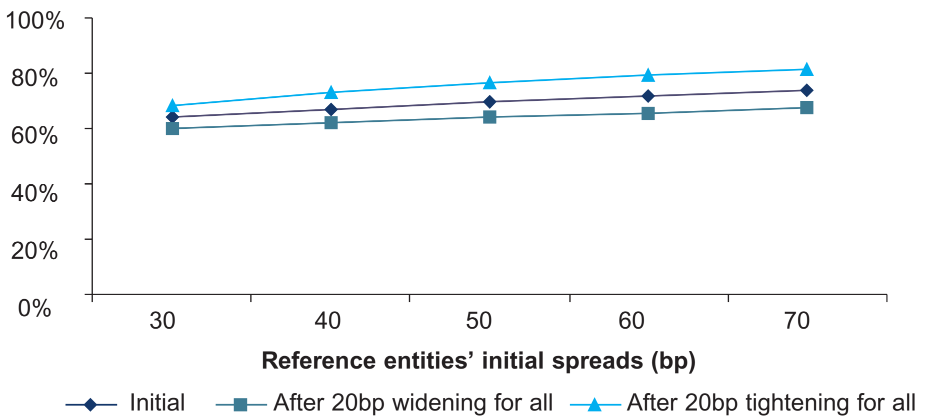
Source: BNP Paribas

Assumptions: 5 reference entities with initial spread levels shown respectively on the horizontal axis, flat credit curves, a uniform recovery assumption of 40%, a pair-wise correlation of 30%, in a 5-year FTD trade.

...but a general spread widening decreases all deltas

Delta sensitivity to a general spread movement is the opposite of that to an individual spread change. Chart 12 shows that when all spreads widen, deltas decrease. This is because default probabilities for all entities increase, increasing the chances of multiple defaults. This has a similar effect to increasing the correlation level, hence lower deltas for all. Vice versa when all spreads tighten (Chart 12).

Chart 12: Delta sensitivity to general spread movement



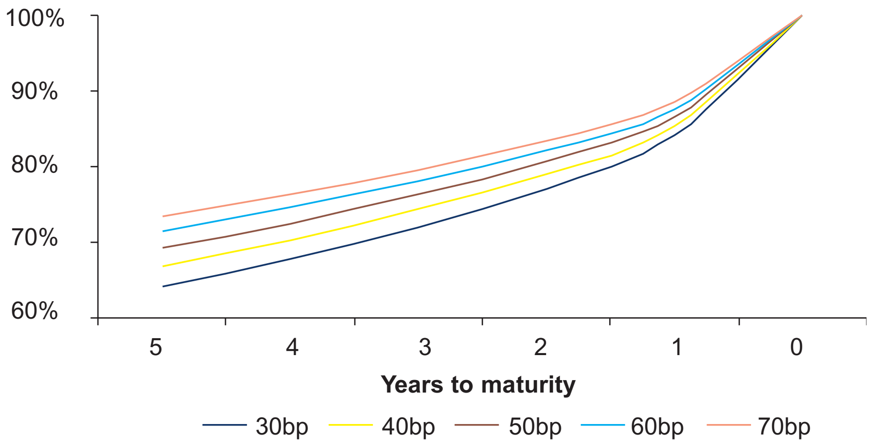
Source: BNP Paribas

Assumptions: 5 reference entities with initial spread levels shown respectively on the horizontal axis, flat credit curves, a uniform recovery assumption of 40%, a pair-wise correlation of 30%, in a 5-year FTD trade.

Deltas need to respond to time decay

Finally, deltas need adjustments even without changes in spreads or correlation, but simply due to time decay. As maturity draws near, there is less time to have multiple defaults, correspondingly increasing the chances of zero or only one default. The name that is expected to default first, if at all, will obviously have a rising delta. Deltas for the expected surviving names will rise too, because their potential unwind costs decrease due to the shorter maturity of the CDS hedges and reduced chances of further defaults. All deltas therefore rise toward 1. Note that the ranking order remains the same throughout this general rise, where a wider name has a higher delta.

Chart 13: Delta sensitivity to time decay



Source: BNP Paribas

Assumptions: 5 reference entities with constant spread levels at 30bp, 40bp, 50bp, 60bp and 70bp respectively, a uniform recovery assumption of 40%, a pair-wise correlation of 30%, in an FTD trade starting at 5 years, with no default at maturity.

Gamma

A dealer buying delta-hedged FTD protection is long idiosyncratic gamma...

Besides the first-order spread risk as captured by deltas, an FTD also entails a secondary risk of spread convexity, or gamma. Gamma measures the change in delta as a result of a change in the underlying spread. If delta increases when spread increases (widens), or if delta decreases when spread tightens, gamma is positive. This is exactly the case in Chart 11 of the previous sub-section, which shows how an individual spread movement changes the name's delta. A dealer, buying FTD protection and selling deltas, is therefore long convexity of individual spread movement. In other words, he is long idiosyncratic gamma ("iGamma"). Correspondingly, the investor is short iGamma in the trade.

A positive iGamma means that the dealer gains if a single spread moves, no matter whether it is widening or tightening. This is because the dealer sells extra CDS protection (increases its delta) at higher spreads, and buys back protection (reduces its delta) at lower spreads in his dynamic hedging. This "sell high, buy low" results in a gain.

...but short systematic gamma

Contrary to iGamma is the group or systematic gamma, or simply Gamma, which represents the convexity of a general movement in spreads. In Chart 12 of the previous sub-section, deltas decrease with a general spread widening and increase with a general tightening, meaning that Gamma is negative. A dealer in this delta-hedged trade is short Gamma, and will lose if spreads move together, in whichever direction, because he will "sell low, buy high". The investor is long Gamma and will benefit from general spread movements.

Another way of interpreting iGamma and Gamma is to see them through realised correlation. iGamma, being the convexity of an individual spread movement, represents a negative realisation of correlation (i.e., spread movements are not correlated). In contrast, Gamma, being the convexity of general spread movements, represents positive realisation of correlation. Since a dealer buying FTD protection and selling deltas is short correlation, he will make money from negative realisation of correlation and lose money if realised correlation is positive. He is therefore long iGamma and short Gamma.

iGamma, instantaneous default and carry

As we mentioned earlier, a delta-hedged position is not carry-neutral. An investor selling delta-hedged FTD protection earns a positive carry. Correspondingly, his counterparty has a negative carry. In the example in Table 3, the investor receives 215bp from the FTD and pays 175bp for the exchange of deltas, earning a carry of 40bp. The dealer is willing to pay this because he will benefit from positive iGamma, as well as the possibility of an instantaneous default (see below). He pays the carry in the hope that the amount will be recaptured by these potential benefits in the course of dynamic delta-hedging.

An investor selling delta-hedged FTD protection earns a positive carry

Table 3: Selling delta-hedged FTD protection earns a positive carry

Reference entity	Spreads	Deltas	Delta-hedging payments
A	30bp	-64.1%	-19bp
B	40bp	-66.9%	-27bp
C	50bp	-69.3%	-35bp
D	60bp	-71.5%	-43bp
E	70bp	-73.5%	-51bp
Sum	250bp		**-175bp**
FTD premium	86% sum of spreads		**215bp**

Source: BNP Paribas

Deltas are negative, meaning that the investor buys CDS protection.

Assumptions: Flat credit curves, a uniform recovery assumption of 40%, a flat correlation of 30%, in a 5-year FTD trade.

When one name widens steadily and becomes a favourite target for default, a dealer will progressively increase its delta toward 1, getting more hedge carry along the way. If this name does default eventually, his position on it will be flat, because the CDS protection sold (delta of 1) will be covered by the FTD protection bought. If the entity does not default and its spread subsequently recovers, the dealer can buy back CDS protection and cash in his gains. The dealer's positive exposure to iGamma, therefore, is expected to help make up the negative carry seen at trade initiation.

The dealer is long iGamma and potential instantaneous default

Even in the event that a default happens unexpectedly and the delta's progressive increase toward 1 does not get finished, the dealer also gains. This is because, with a delta of less than 1, the dealer has more protection bought from the FTD than sold in the CDS, giving him an unexpected gain (although he did not maximise his hedge carry since his delta had not been increased to 1). The possibility of this happening means that he will need to pay for this potential benefit. This, together with his long iGamma position, means the dealer pays a net carry to the investor in delta-hedged trades.

5. FTD INVESTMENT STRATEGIES

Having decomposed FTD trades and reviewed the recent developments in this maturing sector, we conclude this report by summarising the key investment strategies involving FTDs. In the current tight spread environment, FTDs provide investors with a tool to trade leverage for yield. In addition, developments in FTDs' liquidity and investors' familiarity with delta-hedging have made it possible to use FTDs in more sophisticated strategies, such as trading correlation or convexity.

(1) *Leverage for yield:* tight spreads have made many corporate bonds unattractive for direct investment, although investors may like them from a credit perspective. FTDs offer investors an opportunity to maintain exposure to these names, while earning enough to meet their portfolio yield hurdles. In fact, an FTD of investment-grade names can match the yield spread of a high-yield bond. For many investors, this is a better alternative than going down the credit curve in the corporate market, buying higher-yielding credits that they are not comfortable with.

(2) *Trading correlation:* delta-hedged (although not dynamically re-balanced) FTD positions provide a "purer" exposure to correlation than outright positions, as credit exposure in the trade is reduced. If an investor believes that correlation between reference entities is higher than that implied from the basket premium, he can go long correlation by selling FTD protection with delta exchange. He then earns a positive carry, and will have a positive MTM if his views turn out right, i.e., if correlation increases and/or spreads move together. Given the liquidity of the baskets committed by dealers, he can cash in on his gains by unwinding the trade.

(3) *Trading convexity:* for those committed to dynamically risk-managing correlation trades and re-balancing deltas, FTDs are a way to trade spread convexity. An investor expecting an individual spread movement in the basket can buy protection on the FTD and sell the deltas, benefiting from a positive exposure to iGamma (he will typically have a negative carry, though). In contrast, if the investor expects a general spread widening or tightening in the basket, he should do the opposite, in order to go long Gamma and short iGamma, and earn a positive carry.

(4) *Hedging against sporadic credit blow-ups (a low correlation view):* Portfolio managers can use FTDs to hedge against the risk of a sudden default. Buying FTD protection on the names where an investor is long insulates him from an unexpected default, taking his portfolio investment synthetically to a senior position. This particularly applies where an investor is concerned with his overweight exposure to certain investment-grade names, but does not think multiple defaults are likely. Obviously, the price to pay for this hedging strategy can be significant, as the FTD premium is usually a large part of the sum of spreads.

(5) *Creating out-of-the-money portfolio insurance (a high correlation view)*: In contrast to the above strategy where the hedge is against the first unexpected default, this strategy leaves the first credit event unhedged and instead hedges against further defaults. It involves buying CDS protection on a number of names and partially funding the hedge by selling FTD protection on them. If the premium income from the FTD can offset most of the CDS premium payments, then the investor can take a synthetic senior short position at a relatively low cost, and insures his portfolio against multiple defaults. This portfolio insurance is out-of-the-money because the first default is not covered, but the payoff could be significant should a severe downturn occur. The strategy applies where an investor is pessimistic about the credit market trend and thinks that a systemic rise in defaults is likely.

Leo Wang

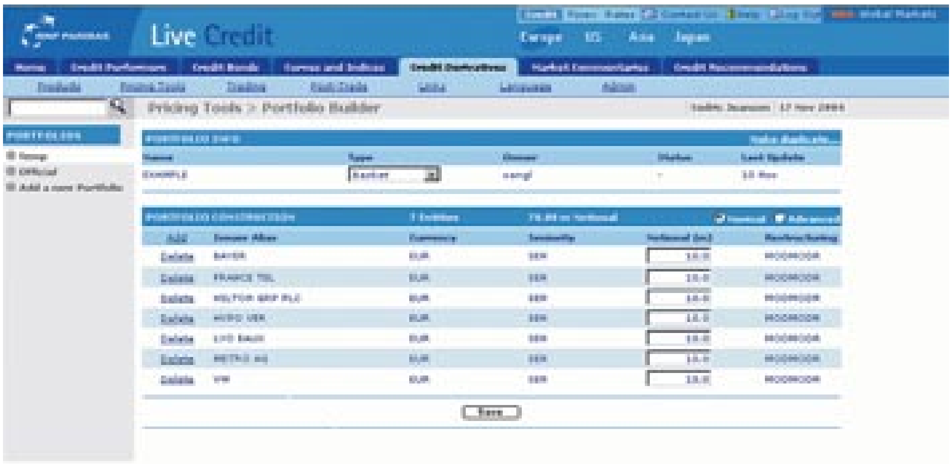
APPENDIX: COMPOSING AND PRICING AN FTD BASKET – A PRACTICAL EXAMPLE

As mentioned in this report, FTDs have become mature products and the sector encompasses standardised baskets common to all market participants, commoditised baskets offered by various dealers, and tailored trades for individual investors. To promote transparency, liquidity as well as customised solutions, dealers make a number of tools available to investors. As a practical example, here we describe the steps to compose and price an FTD basket online using BNP Paribas' LiveCredit.

Step 1:
Log into LiveCredit (www.livecredit.bnpparibas.com). Go to Credit Derivatives > Pricing Tools > Portfolio Builder > Add A New Portfolio. Enter a name for the new basket, and save.

Step 2:
To add reference entities to the basket, click on Add, then search and choose reference entities from the pop-up window. Fill in the notional amounts and save (Exhibit 1). The basket is created. You can choose between Normal or Advanced views, with the Advanced view giving reference entities' details such as sector classification, spreads, ratings and CDS liquidity indicators.

Exhibit 1: Composing an FTD basket



Source: BNP Paribas

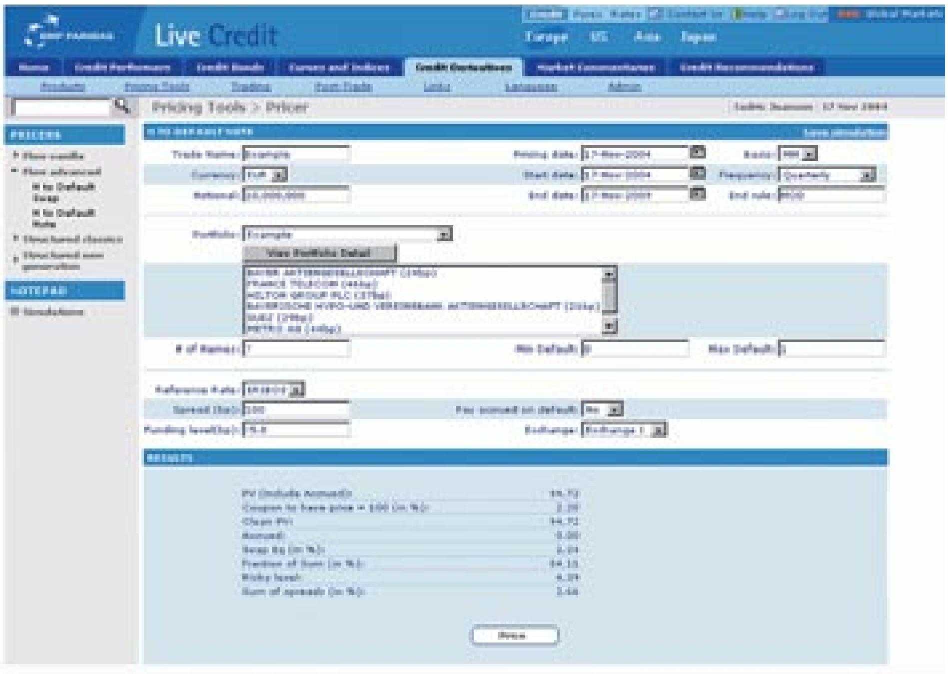
Step 3:
To price the basket, go to Pricing Tools > Pricer > Flow Advanced > N to Default Note (or N to Default Swap). Find your basket in the Portfolio box, and fill in the deal details such as Notional, Reference Rate, Spread, Min Default and Max Default (0 and 1 respectively for FTDs). For pricing FTD notes, BNP Paribas' funding level will be displayed in the Funding Level box.

Step 4: Click on Price and check results (Exhibit 2):
PV (include Accrued) gives the total PV of the trade, assuming buying protection. The amount is then broken down into Clean PV and Accrued, which is obviously 0 for new transactions.

Coupon to Have Price = 100 (in %) gives the pricing premium of the trade, which is 220bp in the example. This is the spread above the Reference Rate. Separately, Swap Equivalent (in %) gives the pricing premium of the trade in unfunded swap form.

The last three rows in the Results section list the Sum of Spreads of the basket, the price's Fraction of Sum, and the Risky Level, which is the risky duration of the trade.

Exhibit 2: Pricing an FTD basket



Source: BNP Paribas

IMPORTANT DISCLOSURES:

Recommendation System:

Type	Terminology	Horizon
Credit Trend (1)	Positive/ Neutral/ Negative	6 months
Relative Value (2)	Outperform/ Market Perform/ Underperform	1 month
Investment Recommendation (3)	Buy/ Hold/ Reduce/ Sell	Up to 6 months

(1) Credit trend is based on underlying Credit fundamentals, business environment and industry trends;
(2) **Relative Value** is based on expected market performance relative to sector;
(3) **Investment Recommendation** is based on BNPP Credit Trend and Relative Value opinions.
(*) **Buy:** Overweight exposure within industry sector, based on strong financial profile, conservative risk and/or solid relativevalue considerations, outperforming or demonstrating average performance within peer group;
Hold: Exhibits solid to strong credit fundamentals, but average total return characteristics within peer group;
Reduce: Credit exposure should be pared down based on weakening fundamentals and/or below average relative value characteristics within peer group;
Sell: Sell exposure largely based on deteriorating credit fundamentals and/or negative headline or event risk.

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