1.2 Structured notes

Structured notes are financial products that appear to be fixed income instruments, but contain embedded options and do not necessarily reflect the risk of the issuing credit.

- Used by investors for exposure in their portfolios to asset classes or markets in which they cannot directly invest due to investment mandates and regulatory restrictions.

Step-up notes

Coupon rate that increases over time.

Deferred coupon bonds

No coupon payment for the deferred period and then a lump sum payment at some specified date and coupon payments until maturity.

Ratchet bonds

Coupon rate that adjusts periodically at a fixed quoted margin over a reference rate. It can only adjust downward based on some preset formula. Once the coupon rate is adjusted down, it cannot be readjusted up if the reference rate subsequently increases.

Range notes

Provide investors with an above market coupon, but they must agree to forego coupon payments when LIBOR falls outside prescribed bounds.

Example
Suppose the market coupon for a conventional note is 6.5%.
A range note pays 8.8% coupon semi-annually conditional on the 6-month LIBOR remains within 4.5-7.5%. The true coupon is computed on a daily accrual basis (coupons are counted on those dates when the LIBOR falls within the range).

Corridor risk

- The investor loses coupon of rate 8.8% when LIBOR either exceeds 7.5% or below 4.5%. This is like the payoff of a digital cap and digital floor, respectively. This is called the "corridor risk".

- In essence, the investor shorts these two options in return for a higher coupon rate – selling volatility.

- Investors have a strong view that rates will stay within a range and often they are structured to reflect an investor's view that is contrary to a particular forward rate curve.

Example

The Kingdom of Sweden issued dollar-denominated corridor Eurobonds in January 1994. The 200 million 2-year Sweden deal, for example, paid out Libor + 75 bp when the 3-month Libor fell between the following rates:

07/02/94 – 07/08/94; 3% to 4%

07/08/94 – 07/02/95; 3% to 4.75%

07/02/95 – 07/08/95; 3% to 5.50%

07/08/95 – 07/02/96; 3% to 6%

The principal is fully protected, and the coupon is sacrificed only on days in which the 3-month Libor is outside the range.

Zero coupon accrual notes

A hybrid version of a zero-coupon bond and an accrual note.

- In a plain vanilla accrual note, an investor receives a coupon based on the number of days that a fixed income benchmark rate stays within a pre-specified range.

- In a zero coupon bond, the investor knows at the time of purchase the bond's maturity and effective yield.

The zero coupon accrual note investor buys the note at a discount. Instead of a set maturity, there is a maximum maturity date. The note's payout is capped at par. When the total return of the principal and the accrued coupon reaches par, the zero coupon accrual note matures.

Uses of zero coupon accrual notes

In a rising interest rate environment, the maturity of the notes accelerates. Fixed income investors are thus able to reinvest their capital at the prevailing higher rates.

- The inherent high convexity built into the zero coupon accrual notes benefits the buyer greatly by reducing the duration of the note as rates rise while lengthening duration as rates fall.

- Unlike range notes where ranges are specified, this product allows investors to bet on a general move up in rates rather than the actual move in basis points.

Example of zero coupon accrual note

A 3-year zero coupon accrual note linked to 6-month LIBOR sold at a price of 90 and a minimum annualized coupon of 2.5% (minimum coupon feature).
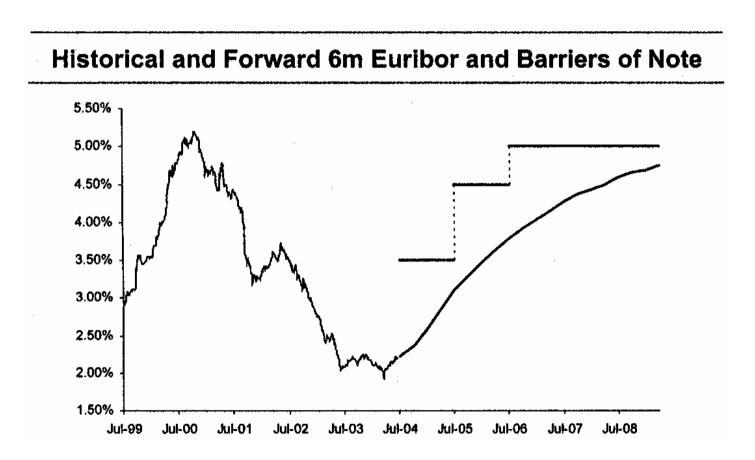
- If the 6-month LIBOR does not rise substantially during the 3-year life of the note, the note will mature in 3 years.

Callable Range Accrual Note

- The call options enable the investor to enhance his yield, compared to a standard Range Accrual Note. Even if the Note is called on the first call date, he would have benefited from a high coupon compared to the market conditions.

- The Range Accrual structures are **very popular with investors**, especially when the implied volatility is high compared to the historical movements of the underlying index.

- The Note will pay a higher coupon if, based on the forward curve, there is a **high probability that the reference index will fix outside the range**.

The range can be tailored to match investor's view on interest rates.

- The graph below shows the forward distribution of the 6m Euribor as well as the upper barriers of the structure, and thus the probability for the index to fix within the range according to market conditions at the time of pricing.

Historical and Forward 6m Euribor and Barriers of Note

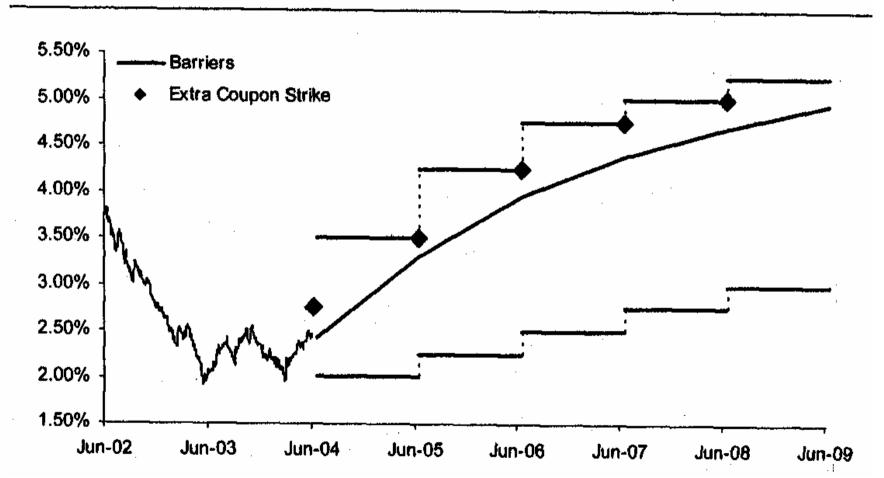|	
Early Redemption Option	The Issuer has the right to redeem the Note at par on each Coupon Date, starting from and including 14 July 2005, subject to a 5 business days prior notice
Coupon	**5.40% × (n/N)**
n	Number of days when the Index fixes between the Lower and Upper Barriers (inclusive) during the relevant Calculation Period
N	Number of days in the relevant Calculation Period

Barriers	Year	Lower barrier	Upper barrier
	1	0.00%	3.50%
	2	0.00%	4.50%
	3-5	0.00%	5.00%

Calculation Period For each Coupon, from the previous Coupon Date (inclusive) to the current Coupon Date (exclusive)

Daycount 30/360

Coupon Payment Dates Quarterly, on 14 October, 14, January, 14 April and 14 July in each year, subject to Business Days adjustment

Boosted Range Accrual Note

- The Boosted Range Accrual Note is a Range Accrual Note that pays an **extra coupon** for each period when the Index fixes above a certain strike. Essentially, it is a Range Accrual Note plus a string of digital caps.

- This product is **designed for investors who believe that the underlying Index is on an upward trend**.

- Compared to the classic Range Accrual structure, where the investor is selling the volatility of the index, volatility risk is reduced by buying volatility digital caps.

- In a volatile market, this product can provide a good pick-up yield, or protection against a rise in the interest rate level, when the cap strike match the upper range accrual barrier.
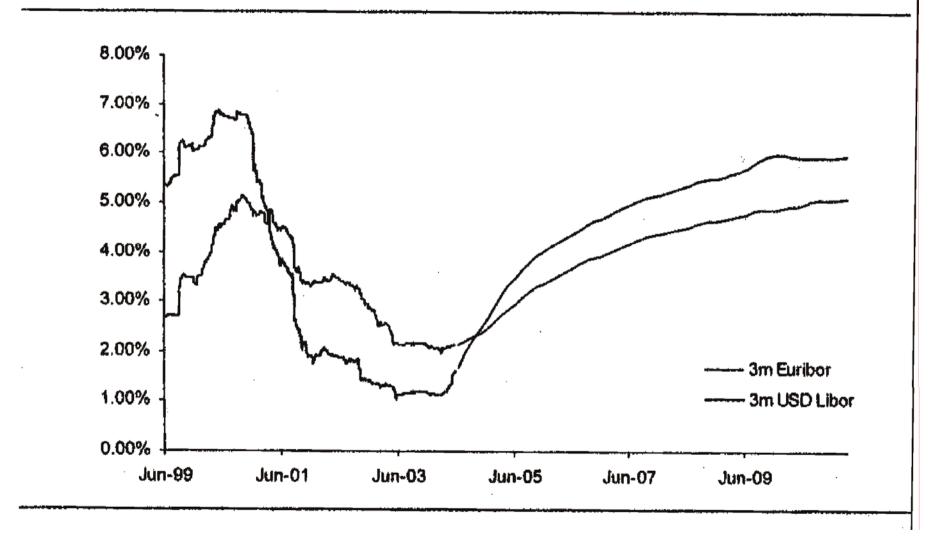
Historical and Forward 12m Euribor vs Barriers and Extra Coupon Strike of the structure

Twin Range Accrual Note

- The coupon of a Twin Range Accrual Note depends on the **daily fixings of two indices** (e.g. 3m USD Libor and 3m Euribor) **being within specific ranges.**

- As the coupon of a simple Range Accrual increases when the probability of the reference index to fix outside the range increases, adding an additional index further increases the probability of fixing outside the range, thus provides an even higher coupon.

- The higher the volatility of each of the underlying indices, the higher the coupon of the Note.

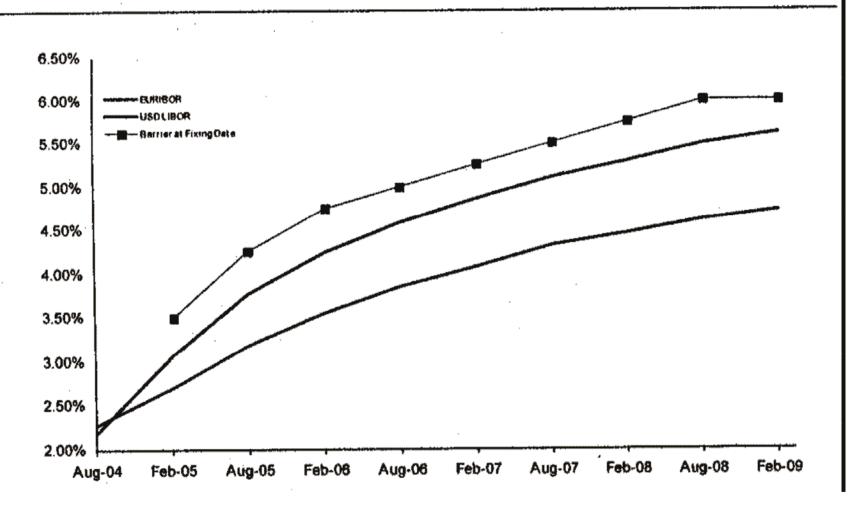- The lower the correlation of the two indices, the higher the coupon of the Note.

Historical and Forward 3m Euribor and 3m USD Libor

TOPSAIL Note

- A TOPSAIL Note pays the **maximum of USD Libor and Euribor plus a spread, as long as both rates remain below a barrier or a series of barriers**.

- If the barrier is breached at the start of any period, a low coupon rate will be paid for that period only; it will not affect future coupon periods.

- It can be structured with a single barrier or several barriers (e.g. step-up) throughout the life of the Note. The barriers can be tailored to match the investor's view of the future path of rates.

- Investors can take advantage of the steep USD curve, but still maintain a minimum coupon rate of Euribor + spread, as long as the barrier is not reached.

Forward 6m Euribor, 6m USD Libor and Barriers of Note

Coupon	**Semester 1**	4.50%
	Thereafter	If $Index_1$ < Barrier and $Index_2$ < Barrier
		Max ($Index_1$, $Index_2$) + 50bps
		Otherwise,
		1.00%
$Index_1$		6m USD Libor,
		Reference Reuters LIBOR01
$Index_2$		6m Euribor,
		Reference Reuters EURIBOR01

Barrier	**Semester 2**	3.50%
	Semester 3	4.25%
	Semester 4	4.75%
	Semester 5	5.00%
	Semester 6	5.25%
	Semester 7	5.50%
	Semester 8	5.75%
	Semesters 9-10	6.00%

Callable Ratchet Inverse Floater Note

- It has the structure of an Inverse Floater plus the coupon being path-dependent: the coupon of each period depends on the level of the previous coupon received.

- The classic structure of the coupon is

$$C_i = \mathbf{Max}[C_{i-1} + M_i - \mathbf{Index}, \mathbf{Floor}],$$
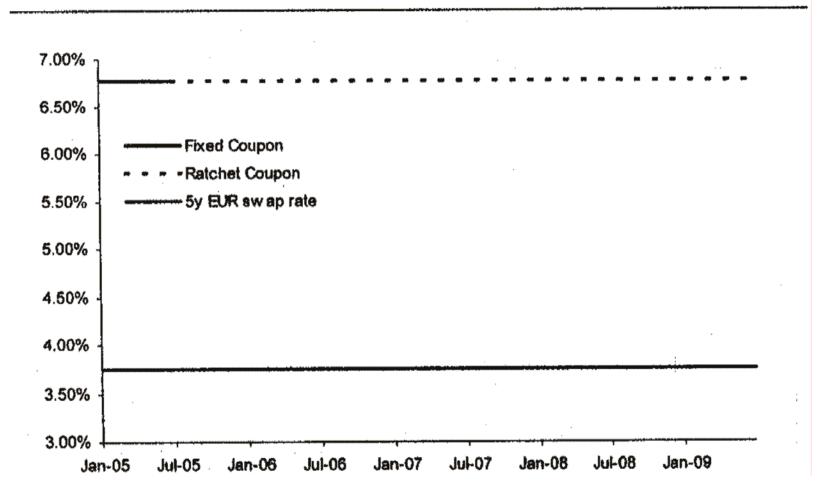
where M_i is the periodic margin.

- This product takes advantage of the steepening of the forward curve and pays a high coupon if the forwards are not above the values chosen for M_i.

- A high **fixed** coupon is usually paid during the non-call period.

Opportunity

- One strategy is to fix the periodic margin M_i, at the level of the forward rates. Thus, contrary to some other structures where the value comes from taking a view that the forwards will not be realized, a high coupon will be paid even if rates follow the forwards or are slightly higher.

Coupon Structure

Legend:
- Fixed Coupon
- Ratchet Coupon
- 5y EUR swap rate

Y-axis: 3.00% to 7.00% (in 0.50% increments)

X-axis: Jan-05, Jul-05, Jan-06, Jul-06, Jan-07, Jul-07, Jan-08, Jul-08, Jan-09

Early Redemption Option

The Issuer has the right to redeem the Note at par on each Coupon Date, starting from and including 14 January 2005, suject to a 5 business days prior notice

Coupon

Semester	Coupon
1-2	6.75%
3	Max(Previous Coupon + 1.50% – Index, Floor)
4	Max(Previous Coupon + 2.25% – Index, Floor)
5	Max(Previous Coupon + 3.00% – Index, Floor)
6	Max(Previous Coupon + 3.75% – Index, Floor)
7	Max(Previous Coupon + 4.50% – Index, Floor)
8	Max(Previous Coupon + 5.25% – Index, Floor)
9	Max(Previous Coupon + 6.00% – Index, Floor)

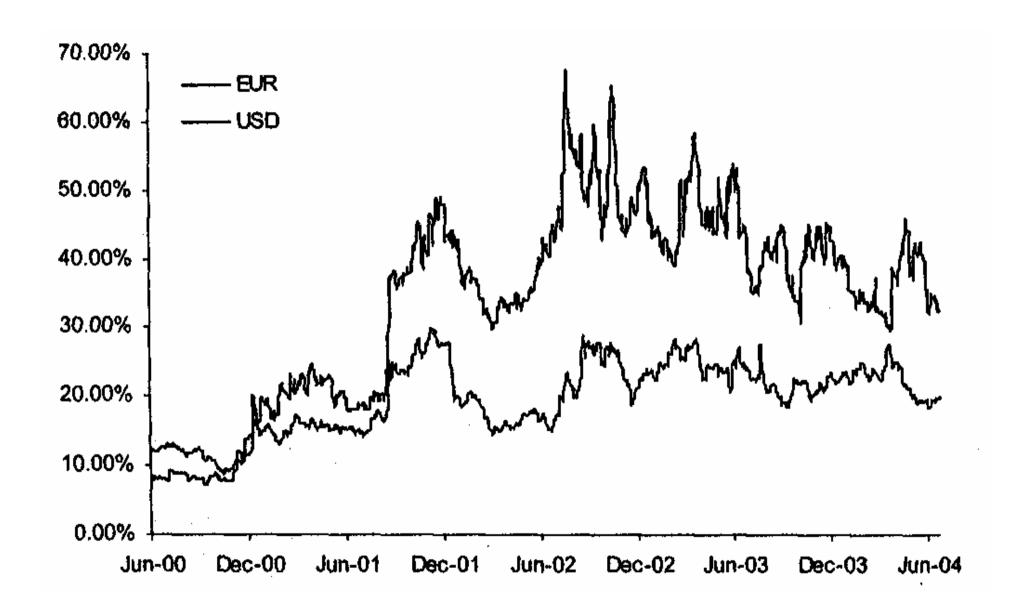|	
Index	6-month Euribor, fixed 2 business days in advance, Reference Reuters EURIBOR01
Floor	0.00%
Coupon Payment Dates	Semi-annually, on 14 January and 14 July in each year, subject to Business Days adjustment

Dual currency bonds

Bond issues that pay coupon interest in one currency but pay the principal in a different currency.

1. The exchange rate that is used to convert the principal and coupon payments into a specific currency is specified at the time the bond is issued.

2. The applicable exchange rate is the prevailing (spot) rate at the time a cash flow is made.

3. Offers to either the investor or the issuer the choice of currency – option currency bonds.

Quanto Callable Range Accrual Note

- The Quanto Callable Range Accrual Note is a Callable range Accrual Note, where the coupon depends on the daily fixing of a **foreign** index being within a specific range.

- When the volatility of an index (e.g. 6m Libor) is high in a certain foreign currency (e.g. USD), the investor, being short volatility, can benefit by fixing the index in the foreign currency, while receiving flows in his domestic currency (e.g. EUR).

- The Quanto Callable Range Accrual Note allows European investors to benefit from the current high USD implied volatility (as indicated by the graph above) without having to enter into a Cross Currency Swap.

CMS note

One-year structured note that takes a view on the 5-year constant maturity swap rate. The par is multiplied by

1 + 5 x (preset strike level – 5-year CMS swap rate at maturity).

That is, the redemption value will be above par as long as the 5-year CMS swap rate remains below the strike.

Given: 5-year CMS spot = 5%

5-year CMS rate one-year forward = 6%

Target: Investor seeks coupon of + 50 bp over market value

Question: What the strike level should be? At least, this number must be less than the forward rate (6%).

- The strike value should be the number that the investor believes that CMS will not reach.

- The investor can cap his downside risk by buying a cap on S, where S is the 5-year CMS rate at the note's maturity.

Spread Range Accrual Note

- The coupon of a Spread Range Accrual Note depends on the spread between the **daily fixings of two interest rates indices** (e.g. the EUR (10y-2y) CMS spread) **being within a specific range**.

- The indices can be Libor or CMS rates and can be in different currencies.

- Spread Range Accrual structures are very popular with investors, especially when the market is anticipating sharp movements in the spread between two indices.

- The high the volatility of the spread and the higher the possibility of the spread being outside the range, the higher the coupon paid.

TASC Note on CMS Spread

- A TASC Note pays a structured coupon, which **upon reaching a Target Switches into a predetermined coupon rate**.

- This rate can either be a fixed rate or a floating rate (with short-term or long-term maturity).

- The structured coupon is linked to the spread between the 10y-2y rates, which narrows dramatically on a forward basis.

Opportunity

- The inversion of the CMS spread allows for a **high initial coupon** with a **high gearing** of the spread.

- In addition, the Note pays a **guaranteed amount of interest**, equal to the Target level.

- Upon reaching the Target level, the investor will still benefit:

  - In the case that the coupon paid is a CMS rate, the investor will, in most cases, benefit from an **above mark-to-market** due to a positive yield curve shape.

  - Similarly, if the Note is structured so that the coupon switches into a fixed rate, this rate will be **above current market levels**.

Fixing 2 business days prior to the Coupon
Payment Date (in arrears), Reference
Reuters ISDAFX2
If on Maturity Date the Cumulative Coupon
has not reached the Target, the Noteholder
receives a Coupon equal to Target less the
sum of all previous Coupons

Otherwise,

$$100\% \times CMS_{10y}$$

Fixing 2 business days in advance,
Reference Reuters ISDAFIX

CMS$_{10y}$

EUR 10y swap rate (Annual, 30/360) vs 6m Euribor (Semi-annually, Act/360)

CMS$_{2y}$

EUR 10y swap rate (Annual, 30/360) vs 6m Euribor (Semi-annually, Act/360)

Target

44.00%

Cumulative Coupon

Sum all previous Coupons, expressed as a percentage of the Notional Amount

Target redemption notes

Example 7.5% USD Target Redemption Index Linked Deposit (issued by Bank of East Asia, 2004)

Selling points - Enjoy potentially higher returns with Index Linked Deposit

- 100% principal protection plus 7.5% guaranteed coupon return over a maximum of 5-year investment period.

- 1st year annual coupon is guaranteed at 6.5% (very juicy), payable semi-annually.

- The remaining coupon rate of 1% will be based on the LIBOR movement. The inverse floater formula is

$$\max\{7\% - 2 \times 6\text{-month LIBOR (in arrears)}, 0\}$$

However, the total coupon received will not shoot beyond the target rate of 7.5%. If the coupon payment accrued during the deposit period is less than the target rate, then the remaining amount will be paid at maturity.

Early termination

Once the accumulated coupon payment reached the target rate, the deposit will be terminated automatically.

Worst scenario

The deposit is held for 5 years until maturity so that the annual return for the deposit is only 1.5% per annum.

Market background

The US Fed policy makers voted unanimously to keep the Fed Fund Rate unchanged at 1% on 28 October 2003, the lowest level in the past 45 years. They had indicated that the interest rate would remain at a low level *for a considerable period*.

Potential risk

If the 6-month LIBOR rises beyond 3.5% one year afterwards and never come down again. The deposit is then held for 5 years until maturity.

Equity target redemption notes

SG Product

- 10-year fund that is 100% capital guaranteed

- Pay a juicy fixed coupon of 10% in the first year

- For Year Two, the coupon payment is referenced to the average performance of the 6 worst stocks in a basket of 24 blue-chip stocks.

  $$\max\{0, 10\% + 0.5 \times \text{average performance of the 6 worst stocks}\}$$

- From Year Three onwards, the investor gets the better of the previous year's coupon or the payout formula.

- Once the aggregate coupon payments reaches or exceeds 20%, the fund terminates with full payment of the coupon for that year.

Worst scenario: 10-year fund with total coupon of 20%
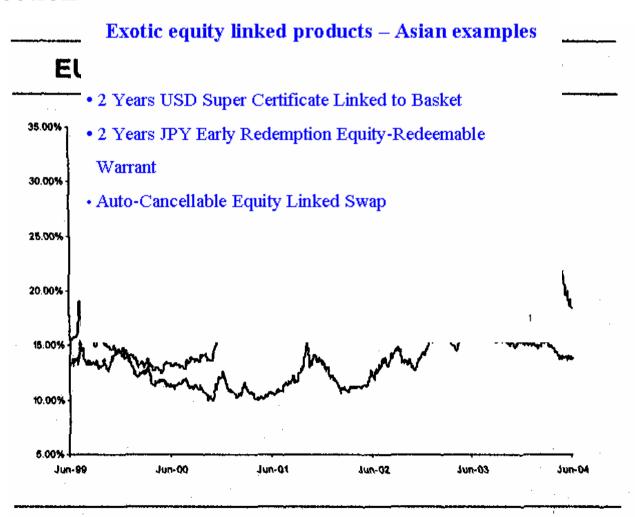
Blending equity and rates

- Design products that have both equity and fixed-income risk.

- The equity and fixed-income markets typically offset each other during economic downturns, therefore hedging the investor against excessive downside in one market.

Volatility Note

- A Volatility Note is an interest rate investment product, which pays a *coupon linked to the absolute variation of an Index over a period of time*.

- The coupon is equal to $C_n = G \times \text{Abs}(\text{Index}_n - \text{Index}_{n-1})$.

- The Volatility Note represents a natural hedging solution to long-term bond investors, such as insurance companies, whose portfolios bear natural negative volatility:
  - (a) if rates rise, the value of their existing portfolio of fixed rate vanilla and callable bonds will fall,
  - (b) if rates fall they will be unable to reinvest any income at a reasonable level.

Opportunity

- In a volatile market, the volatility bond investor takes advantage of any movements of the Index, without having to take a view on the direction ~~of the market~~

Exotic equity linked products – Asian examples

EU

- 2 Years USD Super Certificate Linked to Basket
- 2 Years JPY Early Redemption Equity-Redeemable Warrant
- Auto-Cancellable Equity Linked Swap