

7. Structured Products

An introduction to structured products

An introduction to Structured Products (SPs)

Structured products (SPs) are financial instruments that are designed to meet specific investment objectives by combining two or more financial instruments, typically a debt security (like a bond) and one or more derivatives. These products are pre-packaged investments that can be customized to cater to different risk-return profiles, market views, and investment strategies. As already indicated a few times, Exotic options are often used in the implementation of such structured products.

To meet specific needs that cannot be met from the standardized financial instruments available in the market, structured products are synthetically engineered. SPs can be used for example as an alternative to a direct investment, or as part of the asset allocation process to reduce risk exposure of a portfolio, or to utilize the current market trend. SPs are by nature not homogeneous - as a large number of derivatives and underlying can be used.

A SP is generally a pre-packaged investment strategy which is based on derivatives (the needs of the investor are translated into these derivatives). Theoretically investors can just do this themselves, but the costs, handling and transaction volume requirements of derivatives are beyond many individual investors.

Products can be denominated in any currency, structured within almost any legal and regulatory environment. Underlying assets can come from all over the world (e.g. making investing in Emerging Markets available to a more general public).

The level of complexity from "plain vanilla" to "exotic" and any degree of financial leverage can be achieved by using derivatives.

Key Characteristics of Structured Products

1. **Combination of Instruments:** Structured products typically combine a traditional financial instrument, like a bond, with derivatives such as options, futures, or swaps. This combination allows for a wide variety of payoffs that are not available from simple, traditional investments.
2. **Customization:** These products can be highly customized to suit the specific requirements of investors, such as risk tolerance, market outlook, and income needs. For example, they can be designed to provide principal protection, enhanced yield, or leveraged exposure to an asset.
3. **Underlying Assets:** The performance of structured products is often linked to the performance of underlying assets or indices, which can include equities, commodities, currencies, interest rates, or a basket of assets. The payoff structure can be linked to the performance of these underlying assets.
4. **Risk and Return:** The risk and return profile of structured products can vary widely depending on the structure and the underlying assets. Some structured products are

designed to offer capital protection with lower potential returns, while others may provide higher returns but with greater risk.

5. **Liquidity:** Structured products are often less liquid than standard securities like stocks and bonds. They are usually designed to be held until maturity, and selling them before maturity can result in significant losses or limited market availability.

Common Types of Structured Products at a glance

A list of the most common structured products is given below. We will deepen out these products further below but notes can contain several features of different classes.

1. **Principal-Protected Notes (PPNs):**

- **Description:** These are structured products that guarantee the return of the original principal amount at maturity, regardless of the performance of the underlying asset, while providing potential upside based on that performance.
- **Use Case:** Ideal for conservative investors who want to protect their principal while still having some exposure to potential market gains.

2. **Equity-Linked Notes (ELNs):**

- **Description:** These notes provide returns based on the performance of a specific equity or equity index. They can offer a fixed income component with the potential for additional returns based on the appreciation of the underlying stock or index.
- **Use Case:** Suitable for investors looking to combine income generation with equity market exposure.
- Otherwise Linked notes: similar to ELNs, we can have notes that are linked to interest rates, credit, FX or commodities

3. **Reverse Convertible Notes:**

- **Description:** These are debt instruments that pay a high coupon rate but have the risk of converting into a predetermined number of shares of the underlying asset if the asset price falls below a certain level.
- **Use Case:** Suitable for investors willing to take on some equity risk in exchange for higher income.

4. **Auto-Callable Notes:**

- **Description:** These notes automatically mature before the scheduled maturity date if the underlying asset reaches a predetermined price level. Investors receive a premium in addition to their principal if the note is called early.
- **Use Case:** Ideal for investors seeking enhanced returns and willing to accept the risk of the note being called before maturity.

5. **Barrier Notes:**

- **Description:** These products have payoffs linked to the performance of an underlying asset with specific conditions, such as knock-in or knock-out barriers. The payoff can vary significantly depending on whether the underlying asset reaches or breaches the barrier level.
- **Use Case:** Used by investors looking to capitalize on certain market conditions while managing downside risk.

6. Steepeners and Flatteners:

- **Description:** These are structured notes that provide returns based on the steepness or flatness of the yield curve. A steepener benefits from a widening difference between long-term and short-term interest rates, while a flattener benefits from a narrowing difference.
- **Use Case:** Suitable for investors with views on changes in the yield curve who want to profit from specific interest rate movements.

Principal-Protected Notes (PPNs)

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Principal-Protected Notes (PPNs) are a type of structured financial product that guarantee the return of the original principal amount invested, regardless of the performance of the underlying asset or assets. They are designed to provide investors with a degree of security by ensuring that their initial investment is protected, while still offering the potential for returns based on the performance of a linked asset, such as an equity index, a basket of stocks, commodities, or currencies.

However, the products are still exposed to default risk as the issuing institution can go bankrupt in which case the investor is also losing his investment. A PPN may be suitable for those seeking full protection of their original investment and for investors who have long-term financial obligations. PPNs generally offer a return at maturity linked to an underlying asset. Investors typically give up a portion of the potential gains in exchange for principal protection.

In its most basic form, a principal protected note typically consists of a zero-coupon bond and a derivative. At maturity, the zero-coupon bond is redeemed at par, while the derivative offers participation in an underlying reference asset.

Key Features of Principal-Protected Notes

1. Principal Protection:

- The most defining feature of PPNs is that they guarantee the return of the initial principal amount at maturity. This protection is usually provided by the issuer of the note, which is typically a financial institution. The principal protection means that, no matter how the linked asset performs, the investor will receive back at least the amount initially invested when the note matures.

2. Underlying Asset:

- The return on a PPN is linked to the performance of an underlying asset or a combination of assets. These could include equity indices, individual stocks, bonds, commodities, currencies, or a mix of these. The performance of the underlying asset determines the amount of any additional return (above the principal) that the investor receives.

3. Fixed Maturity:

- PPNs have a fixed maturity date, which is the date at which the principal is repaid to the investor. The investment horizon can vary but is typically between 3 and 10 years.

4. Potential for Upside Participation:

- While the principal is protected, the note allows investors to participate in the potential upside of the underlying asset. This participation might be subject to a cap (maximum return) or might only provide a portion of the asset's actual return, depending on the structure of the PPN.

5. Issuer Credit Risk:

- The principal protection is dependent on the creditworthiness of the issuer. If the issuing financial institution defaults or becomes insolvent, the principal protection may be lost. Therefore, the safety of the principal in a PPN is as strong as the credit quality of the issuer.

Types of Principal-Protected Notes

1. Zero-Coupon PPNs:

- These PPNs are structured using a zero-coupon bond to provide the principal protection. The bond is purchased at a discount and matures at the full face value, ensuring the return of the initial investment. Any remaining funds are used to purchase derivatives linked to the performance of the underlying asset, providing the potential upside.

2. Coupon-Paying PPNs:

- These notes pay periodic coupons, which could be fixed or linked to the performance of the underlying asset. In some cases, the coupon payments might be conditional on the asset performance or other criteria.

3. Buffered PPNs:

- Buffered PPNs offer limited protection against losses of the underlying asset. They typically protect the principal up to a certain amount of loss, beyond which the investor may start to lose some of their principal.

Structure of the PPN

If an investor has 1000 to invest in a market where interest rates are $r = 6.615\%$ and wishes to track Microsoft but is risk-averse to the extent that over a 3 year period, the investor does not want to risk losing money. Note that even if his initial capital is secured at \$1000, the investor would have still lost out compared to the bank account or a fixed income investment that would have yielded over 20% return over 3 years.

If the principal requires to be protected in 100%, one could consider buying a zero coupon bond that pays back 1000 in $T = 3$ years time. If we assume continuously compounding interest rates, the current value of such a bond is $1000 \exp(-rT) = \exp(0.06615 \times 3) = 820$ USD. This means there is $1000 - 820 = 180$ USD to invest into options that participate into Apple's performance.

The participation that can be offered will depend on the amount of options one can purchase and hence on the price of the option(s) involved. Let's assume we will just use a simple European Call option with a strike set to the current value of the share. The payoff for the investor at maturity can be then written as

$$1000 + A \max(S(T) - S(0), 0) = 1000 + A \cdot S(0) \cdot \max\left(\frac{S(T) - S(0)}{S(0)}, 0\right) = 1000 \cdot \left[1 + \frac{A \cdot S(0)}{1000} \left(\frac{S(T)}{S(0)} - 1\right)\right]$$

The ratio

$$\frac{A \cdot S(0)}{1000}$$

is the structured participation that can be offered, tracking the return of Microsoft. The term 1 in between the brackets is the component of the zero-coupon that yields 100% at maturity and \$1000 is the principal in this note.

Assume that the market is such that:

- The price for a European Call option is $EC = 90$
- The 3-year zero coupon bond is $ZCB = 820$
- And the underlying security is currently $S(0) = 400$.

Clearly with the 180 USD than is at our disposal, we can purchase two ECs and this gives us a participation rate into the structured note of:

$$A \times S(0)/100 = 2 \times 400/1000 = 80\%$$

Now, if we assume that the EC is more expensive (as we will see this can be due to a higher volatility), and we start from the following market conditions:

- The price for a European Call option is $EC = 180$
- The 3-year zero coupon bond is $ZCB = 820$
- And the underlying security is currently $S(0) = 400$.

Clearly with the 180 USD than is at our disposal, we can now only purchase 1 EC and this gives us a participation rate into the structured note of:

$$A \times S(0)/100 = 1 \times 400/1000 = 40\%$$

Of course, offering a structure linked to Microsoft's performance but only being able to offer 40% participation, might not attract a lot of investors. Clever financial engineering can help us to either to allocate more funds to the purchase of the option or reduce the option price.

How to allocate more funds to the option part of the structure?

This can be done by only lowering the protection on the principal. If we only wish to guarantee the principal up to 90%, we can reduce the notional in the zero coupon bond such that at maturity it pays back 900 usd such that the payoff structure becomes

$$900 + A \cdot \max(S(T) - S(0), 0) = 1000 \cdot \left[0.90 + \frac{A \cdot S(0)}{1000} \left(\frac{S(T) - S(0)}{S(0)} \right)^+ \right]$$

With the same market conditions (but adjusted ZCB):

- The price for a European Call option is $EC = 180$
- The 3-year zero coupon bond is $ZCB = 740$
- And the underlying security is currently $S(0) = 400$,
we are able to spend $1000 - 740 = 260$ on purchasing options and we can purchase $A = 1.44$ of such options (we will assume that we can buy fractions of quantities in any instrument).
This then leads to a participation of 57.78%.

How can we make the option cheaper (but still visually attractive to an investor)?

Rather than using an ATM European Call option, we can use a Barrier (see [Barrier Options](#)) to

reduce the price of the option. We can for example use a Down-and-out barrier call option that stipulates if the barrier of $H = 50\%$ in the share price is never hit, we have a regular call option. If the share price does get down to the barrier, the investment will not recover as the option will be knocked out. The investor will only receive the principal back.

The payout of the structure is then given by

$$1000 + A \max(S(T) - S(0), 0) \cdot 1(\min_{0 \leq t \leq T} S(t) > H)$$

where we used the indicator function to denote the condition on the barrier.

The market conditions are now such that

- The price for a European Call option is $EC = 180$
- The price for the $DOBC = 120$
- The 3-year zero coupon bond is $ZCB = 820$
- And the underlying security is currently $S(0) = 400$.

This means we have 180 usd to invest and we can purchase $180/120 = 1.5$ of those options. This leads to a participation of $1.5 \times 400/1000 = 60\%$.

Equity-Linked Notes (ELNs)

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Equity-Linked Notes (ELNs) are structured financial products that combine features of both fixed-income and equity investments. These notes typically offer returns linked to the performance of an underlying equity asset, such as a stock, a basket of stocks, or an equity index, while providing some level of income or fixed return. ELNs are designed to cater to investors who seek higher returns than traditional fixed-income products but are willing to take on some equity market risk.

Key Features of Equity-Linked Notes (ELNs)

1. Underlying Equity Asset:

- The return on an ELN is tied to the performance of a specific equity asset, which can be an individual stock, a basket of stocks, or an equity index. The choice of the underlying asset allows the investor to target specific market exposures or themes.

2. Fixed or Variable Coupon:

- ELNs often provide a fixed or variable coupon, which is usually higher than that of traditional bonds. The coupon can be paid periodically (e.g., quarterly, semi-annually) and may be contingent on the performance of the underlying asset. In some cases, the coupon rate might be adjusted based on the movement of the equity asset.

3. Capital at Risk:

- Unlike [Principal-Protected Notes \(PPNs\)](#), ELNs typically do not offer full principal protection. The investor's principal is at risk if the underlying equity asset performs poorly. Depending on the structure of the ELN, the investor may lose some or all of the principal invested if the underlying asset declines below a specified level.

4. Participation Rate:

- ELNs can have a participation rate that determines how much of the gain (or loss) in the underlying asset's value is passed on to the investor. For example, a participation rate of 100% means the investor fully participates in the asset's price movements, while a rate of 50% means the investor participates in only half of the asset's gains or losses.
- Some ELNs can have participation rates larger than 100% as well given a boost to the participation of the market. Note that the use of derivatives excludes the right to receive dividends, which is why it is possible to structure ELNs with participations as large as 300%.
- It is also possible to structure bearish ELNs that offer a positive participation on a negative performance of the index. In other words, it provides the investor the ability to be short.

5. **Maturity:**

- ELNs have a defined maturity date, typically ranging from a few months to several years. At maturity, the payoff to the investor depends on the performance of the underlying equity asset relative to its initial price or a predetermined strike price.

6. **Issuer Credit Risk:**

- The payout and return of ELNs depend on the creditworthiness of the issuing financial institution. If the issuer defaults or becomes insolvent, the investor may lose their investment, irrespective of the underlying asset's performance.

Common Types of Equity-Linked Notes

1. **Bullish ELNs:**

- **Description:** These notes are designed for investors with a positive outlook on the underlying equity asset. The investor gains if the asset appreciates above a certain level but can also suffer losses if the asset declines below the purchase price or a pre-set barrier.
- **Use Case:** Suitable for investors who want to capitalize on potential equity market gains while receiving higher yields than traditional bonds.

2. **Bearish ELNs:**

- **Description:** These are structured for investors who anticipate a decline in the underlying equity asset. The notes might offer a fixed coupon if the asset stays below a certain level, providing returns in a declining market.
- **Use Case:** Ideal for investors seeking to benefit from anticipated market downturns while earning a fixed return.

3. **Range ELNs:**

- **Description:** These notes pay a fixed coupon as long as the underlying asset's price remains within a specified range. If the price moves outside this range, the coupon might be reduced, or the investor might face a loss.
- **Use Case:** Suitable for investors who believe the underlying asset will trade within a certain price range.

4. **Callable ELNs:**

- **Description:** These ELNs can be called (redeemed early) by the issuer if certain conditions are met, typically if the underlying equity asset reaches a specific price level.

If called, the investor receives a predetermined payout, often at a premium.

- **Use Case:** Attractive to investors seeking higher yields with the possibility of early redemption.

5. Reverse Convertible ELNs:

- **Description:** These are high-yield notes that convert into the underlying equity asset if its price falls below a predetermined level at maturity. If the price stays above the level, the investor receives the principal back along with the coupon payments.
- **Use Case:** Suitable for investors who want to earn high coupons and are willing to take on equity risk.

Reverse Convertible Notes (RCNs)

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Reverse Convertible Notes (RCNs) are a type of structured financial product that pays a high coupon rate but carries the risk of converting the principal into a predetermined amount of an underlying asset, usually shares of a stock or a basket of stocks, if certain conditions are met. These notes are designed to provide investors with an enhanced high yield compared to traditional fixed-income securities, in exchange for taking on more risk, particularly the risk associated with the underlying asset. These notes often create a risk for the investor of losing some or all of its principal loss through conversion into an underlying asset.

Key Features of Reverse Convertible Notes (RCNs)

1. High Coupon Payments:

- RCNs offer higher coupon payments than traditional fixed-income securities. The high yield compensates investors for the added risk of potential conversion into the underlying asset, especially if the asset performs poorly.

2. Underlying Asset:

- The underlying asset of an RCN is typically a stock or a basket of stocks. The performance of this asset directly affects whether the principal is repaid in cash or converted into the underlying shares at maturity.

3. Conversion Risk:

- If the underlying asset's price falls below a predetermined strike price or barrier level at maturity, the principal is converted into a pre-specified number of shares of the underlying asset. If the asset's price remains above the barrier, the investor receives their full principal in cash.

4. Strike Price or Barrier Level:

- The strike price or barrier level is the price of the underlying asset that triggers the conversion of the principal into shares. It is set at the time of issuance and is usually below the current market price of the underlying asset to provide some cushion.

5. Maturity:

- RCNs have a defined maturity period, typically ranging from a few months to a few years. At maturity, the final payout is determined based on the performance of the underlying asset relative to the strike price or barrier level.

6. Issuer Credit Risk:

- Like all structured notes, RCNs are subject to the credit risk of the issuer. If the issuer defaults or becomes insolvent, investors could lose some or all of their investment, regardless of the performance of the underlying asset.

How Reverse Convertible Notes Work

- **At Issuance:** An investor purchases an RCN with a specified coupon rate and maturity date. The note is linked to an underlying asset, such as a stock, with a predefined strike price or barrier level.
- **During the Term:** The investor receives periodic coupon payments, which are generally higher than the interest from traditional bonds, compensating for the risk of conversion into the underlying asset.
- **At Maturity:**
 - **If the underlying asset's price is above the barrier level:** The investor receives their original principal in cash.
 - **If the underlying asset's price falls below the barrier level:** The investor receives shares of the underlying asset equivalent to the principal amount divided by the asset's initial price (or another agreed-upon conversion rate).

Example of a Reverse Convertible Note

Imagine an RCN with the following parameters:

- **Underlying Asset:** Stock XYZ
- **Initial Price of XYZ:** \$100 per share
- **Barrier Level:** \$80 per share
- **Coupon Rate:** 10% annually
- **Maturity:** 1 year
- **At Issuance:** An investor buys the RCN for \$1,000. They receive a 10% coupon, meaning they get \$100 in interest payments over the year.
- **At Maturity:**
 - **Scenario 1:** If Stock XYZ is trading at \$85 (above the barrier of \$80), the investor receives their \$1,000 principal back in cash.
 - **Scenario 2:** If Stock XYZ is trading at \$75 (below the barrier of \$80), the investor receives 10 shares of XYZ instead of \$1,000 in cash. The market value of these 10 shares at \$75 each is only \$750, resulting in a \$250 loss on the principal.

Auto-callable Notes (ACNs)

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Auto Callable Notes are structured financial products that pay periodic coupons and have the potential for early redemption or "auto call" by the issuer if certain conditions are met. The decision to call the note is typically based on the performance of an underlying asset, such as a stock, a basket of stocks, or an index. If the underlying asset meets or exceeds a predefined level on specific observation dates, the note is automatically called, and the investor receives the principal back along with the accrued interest. If not called, the note continues to pay coupons until the next observation date or maturity.

Key Features of Auto Callable Notes

1. Underlying Asset:

- The return of an auto callable note is linked to the performance of an underlying asset. This could be a single stock, a basket of stocks, an index, or other assets. The performance of this underlying asset determines whether the note will be called early or continue to maturity.

2. Automatic Call Feature:

- Auto callable notes have predefined observation dates (typically quarterly, semi-annually, or annually) where the performance of the underlying asset is checked. If the asset's price meets or exceeds a specified level (often referred to as the "auto-call level" or "knock-out level") on an observation date, the note is automatically called, and the investor receives their initial investment plus a coupon.

3. Coupon Payments:

- These notes typically pay fixed or variable coupons, which can be attractive to investors seeking regular income. The coupon rates are usually higher than those of traditional bonds, compensating for the potential risks involved.

4. Capital Risk:

- If the note is not called early, it will continue until maturity. At maturity, the return of the principal depends on the performance of the underlying asset relative to a predetermined "protection barrier" or "knock-in level." If the asset's price falls below this barrier at maturity, the investor may receive less than their initial investment.

5. Maturity:

- Auto callable notes have a fixed maturity, typically ranging from one to five years. If the note is not called on any observation date, it will reach its maturity, at which point the final payout depends on the underlying asset's performance.

6. Issuer Credit Risk:

- As with other structured products, auto callable notes are subject to the credit risk of the issuer. If the issuer defaults or becomes insolvent, the investor could lose some or all of their investment, regardless of the underlying asset's performance.

How Auto Callable Notes Work

1. At Issuance:

- An investor purchases an auto callable note with a specified maturity date, coupon rate, underlying asset, auto-call levels, and protection barrier.

2. During the Term:

- On each observation date, the price of the underlying asset is compared to the auto-call level.
- **If the asset price meets or exceeds the auto-call level**, the note is called, and the investor receives their principal back along with the accrued coupon payment.
- **If the asset price is below the auto-call level**, the note continues, and the investor receives the coupon payment for that period.

3. At Maturity:

- If the note is not called early, the investor receives the final coupon payment.
- **If the underlying asset's price is above the protection barrier:** The investor receives their full principal back.
- **If the underlying asset's price is below the protection barrier:** The investor may receive a reduced amount based on the performance of the underlying asset.

Example of an Auto Callable Note

Suppose an auto callable note has the following terms:

- **Underlying Asset:** Stock Index ABC
- **Initial Index Level:** 1,000
- **Auto-Call Level:** 1,000 (100% of initial level) on quarterly observation dates
- **Protection Barrier:** 800 (80% of initial level) at maturity
- **Coupon Rate:** 8% annually
- **Maturity:** 2 years
- **At Issuance:** The investor purchases the note with a \$1,000 investment. The note pays an 8% annual coupon.
- **Observation Dates:**
 - **After 3 months:** If the index is at 1,000 or higher, the note is called, and the investor receives \$1,000 plus an 8% coupon (annualized for the period). If the index is below 1,000, the note continues, and the investor receives a quarterly coupon payment.
 - This process repeats at each subsequent observation date (6 months, 9 months, etc.).
- **At Maturity:**
 - **If the note is not called early and the index is at or above 800:** The investor receives the full \$1,000 principal plus the final coupon payment.
 - **If the note is not called early and the index is below 800:** The investor receives less than the principal, proportional to the decline in the index level relative to the initial level.

Barrier Notes (BNs)

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Barrier Notes are a type of structured financial product that provides returns based on the performance of an underlying asset, such as a stock, index, or commodity. These notes incorporate a barrier feature that affects the payout, depending on whether the underlying asset reaches or breaches a predefined price level during the note's term.

The key characteristic of barrier notes is that they offer a higher coupon rate or potential yield compared to traditional bonds due to the added complexity and risk associated with the barrier feature. Investors in barrier notes must understand how the barrier conditions affect the payoff structure.

Key Features of Barrier Notes

1. Underlying Asset:

- The performance of the barrier note is linked to an underlying asset, such as a stock, a basket of stocks, an index, or another financial instrument. The underlying asset's price movements determine whether the barrier condition is triggered.

2. **Barrier Level:**

- The barrier level is a predefined price point of the underlying asset. It can be set above (up-and-out or up-and-in) or below (down-and-out or down-and-in) the asset's current price.
- The terms "knock-in" and "knock-out" are commonly used:
 - **Knock-in Barrier:** The note becomes active or starts paying a coupon if the underlying asset's price reaches or breaches the barrier level.
 - **Knock-out Barrier:** The note stops paying a coupon or ceases to exist if the underlying asset's price reaches or breaches the barrier level.

3. **Coupon Payments:**

- Barrier notes typically offer periodic coupon payments, which are often higher than those of traditional bonds due to the added risk of the barrier feature. The coupon structure can vary, and payments may depend on whether the barrier has been breached.

4. **Maturity:**

- These notes have a fixed maturity date, usually ranging from one to five years. At maturity, the final payout depends on the underlying asset's price relative to the barrier level and the note's terms.

5. **Issuer Credit Risk:**

- Like other structured products, barrier notes are subject to the credit risk of the issuer. If the issuer defaults, the investor may lose some or all of their investment, regardless of the underlying asset's performance.

Types of Barrier Notes

1. **Up-and-Out Barrier Notes:**

- The note is active unless the underlying asset's price rises to or above a specified barrier level. If the barrier is breached, the note is "knocked out," and the investor may receive only a nominal amount or a reduced payoff.

2. **Down-and-Out Barrier Notes:**

- The note is active unless the underlying asset's price falls to or below a specified barrier level. If the barrier is breached, the note is "knocked out," and the investor may receive only a nominal amount or a reduced payoff.

3. **Up-and-In Barrier Notes:**

- The note only becomes active if the underlying asset's price rises to or above a specified barrier level. If the barrier is not breached, the note does not pay a coupon, and the investor may receive a nominal amount or no return.

4. **Down-and-In Barrier Notes:**

- The note only becomes active if the underlying asset's price falls to or below a specified barrier level. If the barrier is not breached, the note does not pay a coupon, and the

investor may receive a nominal amount or no return.

How Barrier Notes Work

1. At Issuance:

- An investor purchases a barrier note with a specified maturity date, coupon rate, underlying asset, and barrier level. The barrier level could be set either above or below the current price of the underlying asset.

2. During the Term:

- The price of the underlying asset is continuously monitored relative to the barrier level.
- **If the barrier is not breached:** Depending on the type of barrier note, the investor receives coupon payments and may receive their full principal back at maturity.
- **If the barrier is breached:** The payout depends on the note's specific terms. For example, in a knock-out note, the note ceases to pay coupons and may return a nominal amount. In a knock-in note, the note starts paying coupons or becomes active.

3. At Maturity:

- The final payout to the investor depends on whether the barrier was breached during the note's term and the terms of the note.
- **If the barrier is not breached (knock-out):** The investor receives the full principal back plus any accrued coupon payments.
- **If the barrier is breached (knock-in):** The investor receives a payout based on the performance of the underlying asset or a reduced amount depending on the terms.

Example of a Barrier Note

Suppose a barrier note has the following terms:

- **Underlying Asset:** Stock XYZ
- **Initial Price of XYZ:** \$100 per share
- **Barrier Level:** \$120 (up-and-out barrier)
- **Coupon Rate:** 10% annually
- **Maturity:** 2 years
- **At Issuance:** The investor purchases the note with a \$1,000 investment. The note pays a 10% annual coupon as long as the stock price does not rise to or above \$120.
- **During the Term:**
 - **If Stock XYZ stays below \$120:** The investor receives the 10% annual coupon.
 - **If Stock XYZ rises to \$120 or higher at any point:** The note is "knocked out," and the investor stops receiving coupon payments. The investor may receive only a nominal amount or a reduced return at maturity.
- **At Maturity:**
 - **If the note is not knocked out:** The investor receives the full \$1,000 principal back plus the final coupon payment.
 - **If the note is knocked out:** The investor may receive only a nominal amount or a reduced payout.

Steepteners and Flatteners

Steepteners and Flatteners

Steepteners and Flatteners are types of structured financial products designed to provide returns based on the changes in the shape of the yield curve. The yield curve represents the relationship between interest rates (or yields) and the maturity of debt securities, typically government bonds. These products are primarily used by investors to take advantage of their expectations about future changes in interest rates and the yield curve. Steepteners profit from a steepening yield curve, while flatteners profit from a flattening yield curve.

What is the Yield Curve?

The yield curve plots the interest rates of bonds with equal credit quality but differing maturity dates. The most commonly referenced yield curve is that of U.S. Treasury securities. The shape of the yield curve reflects the market's expectations for future interest rates, economic growth, and inflation. It can take several forms:

- **Normal Yield Curve:** Upward sloping, indicating higher yields for longer maturities, typically reflecting expectations of economic growth and rising interest rates.
- **Inverted Yield Curve:** Downward sloping, indicating higher yields for shorter maturities, often seen as a signal of economic slowdown or recession.
- **Flat Yield Curve:** Little difference in yields between short and long maturities, suggesting uncertainty about future economic conditions.

Steepteners

Steepteners are structured notes or financial products that benefit from a steepening of the yield curve. A steepening occurs when the spread between long-term and short-term interest rates increases. This can happen when long-term rates rise faster than short-term rates or when short-term rates fall faster than long-term rates.

How Steepteners Work

- **Underlying Mechanism:** A steeptener typically pays a return that increases if the yield curve steepens. The payout is often linked to the difference, or spread, between yields on two specific points on the yield curve, such as the difference between the 10-year and 2-year Treasury yields.
- **Example:** A typical steeptener note might pay a fixed coupon initially, then switch to a variable coupon that increases as the difference between the 10-year and 2-year Treasury yields widens. If the yield spread widens from 1% to 2%, the coupon payment could increase accordingly.

Investment Rationale

- **Steepteners** are attractive to investors who believe that the yield curve will steepen, perhaps due to expectations of higher future inflation, economic growth, or changes in monetary policy (e.g., central banks raising rates on the long end to combat inflation).

Flatteners

Flatteners are structured notes or financial products that benefit from a flattening of the yield curve. A flattening occurs when the spread between long-term and short-term interest rates decreases. This can happen when long-term rates fall faster than short-term rates or when short-term rates rise faster than long-term rates.

How Flatteners Work

- **Underlying Mechanism:** A flattener typically pays a return that increases if the yield curve flattens. The payout is linked to the reduction in the yield spread between two points on the yield curve, such as the 10-year and 2-year Treasury yields.
- **Example:** A typical flattener note might pay a fixed coupon initially and then switch to a variable coupon that increases as the difference between the 10-year and 2-year Treasury yields narrows. If the yield spread narrows from 2% to 1%, the coupon payment could increase accordingly.

Investment Rationale

- **Flatteners** are attractive to investors who believe that the yield curve will flatten, possibly due to expectations of an economic slowdown, lower inflation, or central bank actions that raise short-term rates or lower long-term rates (such as through quantitative easing).

Key Features of Steepeners and Flatteners

1. Link to Interest Rate Movements:

- The returns on steepeners and flatteners are directly tied to changes in the yield curve. This makes them sensitive to interest rate movements and monetary policy changes.

2. Variable Coupon Payments:

- Unlike traditional bonds that pay a fixed coupon, steepeners and flatteners typically have variable coupons that change based on the shape of the yield curve.

3. Maturity:

- These notes have a fixed maturity date, which can range from a few months to several years. The performance of the note is dependent on yield curve movements over this period.

4. Issuer Credit Risk:

- As with other structured products, steepeners and flatteners are subject to the credit risk of the issuer. If the issuer defaults, the investor may lose some or all of their investment.

5. Potential for High Returns:

- If the investor's expectations about the yield curve movement are correct, these products can provide high returns. However, they also come with the risk of loss if the yield curve moves in the opposite direction of what was anticipated.

Bonus Certificates (BCs)

Bonus Certificates (BCs)

A **Bonus Certificate** is a type of structured financial product that offers investors a return based on the performance of an underlying asset, such as a stock, index, or commodity, with both downside protection and a potential bonus payout if certain conditions are met. It is designed to provide investors with a combination of capital protection up to a certain level and enhanced returns in stable or moderately rising markets.

Key Features of Bonus Certificates

1. Underlying Asset:

- Bonus certificates are linked to the performance of an underlying asset, such as a single stock, a basket of stocks, an index, or a commodity. The value of the certificate is directly tied to the price movements of this underlying asset.

2. Bonus Level:

- The bonus level is a predefined level above the current price of the underlying asset. If, at maturity, the underlying asset's price has not fallen below a specific barrier (known as the barrier level), the investor receives the bonus payout, which is typically higher than the initial investment.

3. Barrier Level:

- The barrier level (also known as the knock-in level) is a critical feature that provides partial capital protection. If the underlying asset's price does not breach this barrier during the certificate's term, the investor receives at least the initial investment back, plus the potential bonus payout.
- If the barrier is breached at any point during the life of the certificate, the capital protection and bonus payout are no longer guaranteed. The final payout will then depend on the actual performance of the underlying asset.

4. Capital Protection:

- Partial capital protection is provided up to the barrier level. If the underlying asset's price does not fall below the barrier level during the term of the certificate, the investor receives at least the nominal amount invested back. However, if the barrier is breached, the investor is exposed to the full downside risk of the underlying asset.

5. Bonus Payout:

- The bonus payout is a fixed percentage return provided to the investor if the underlying asset's price does not breach the barrier level during the life of the certificate. This payout is higher than what would be achieved by simply investing in the underlying asset, assuming moderate positive or sideways market movements.

6. Maturity:

- Bonus certificates have a fixed maturity date, usually ranging from one to three years. At maturity, the final payout is determined based on whether the barrier level was breached during the term and the performance of the underlying asset.

How Bonus Certificates Work

1. At Issuance:

- An investor purchases a bonus certificate with a predefined bonus level, barrier level, and maturity date. The initial price of the certificate is typically close to the price of the underlying asset or the nominal amount invested.

2. During the Term:

- The performance of the underlying asset is continuously monitored. If the asset's price never falls below the barrier level, the investor qualifies for the bonus payout at maturity.
- If the barrier is breached, the protection is lost, and the payout at maturity will be directly linked to the underlying asset's performance.

3. At Maturity:

- **If the Barrier is Not Breached:** The investor receives the initial investment back plus the bonus payout.
- **If the Barrier is Breached:** The investor receives a payout based on the performance of the underlying asset, which could be less than the initial investment if the underlying asset has declined in value.

Example of a Bonus Certificate

Suppose a bonus certificate has the following terms:

- **Underlying Asset:** Stock XYZ
- **Initial Price of XYZ:** \$100 per share
- **Bonus Level:** 10% (at maturity, provided the barrier is not breached)
- **Barrier Level:** \$80 (20% below the initial price)
- **Maturity:** 1 year

Scenarios at Maturity

1. Barrier Not Breached:

- If Stock XYZ never falls below \$80 during the year, the investor receives the bonus payout of 10%. Therefore, the investor receives \$110 (\$100 initial investment + \$10 bonus).

2. Barrier Breached:

- If Stock XYZ falls below \$80 at any point during the year and then closes at \$90 at maturity, the investor does not receive the bonus payout. Instead, the payout is based on the final value of the underlying asset, which would be \$90.

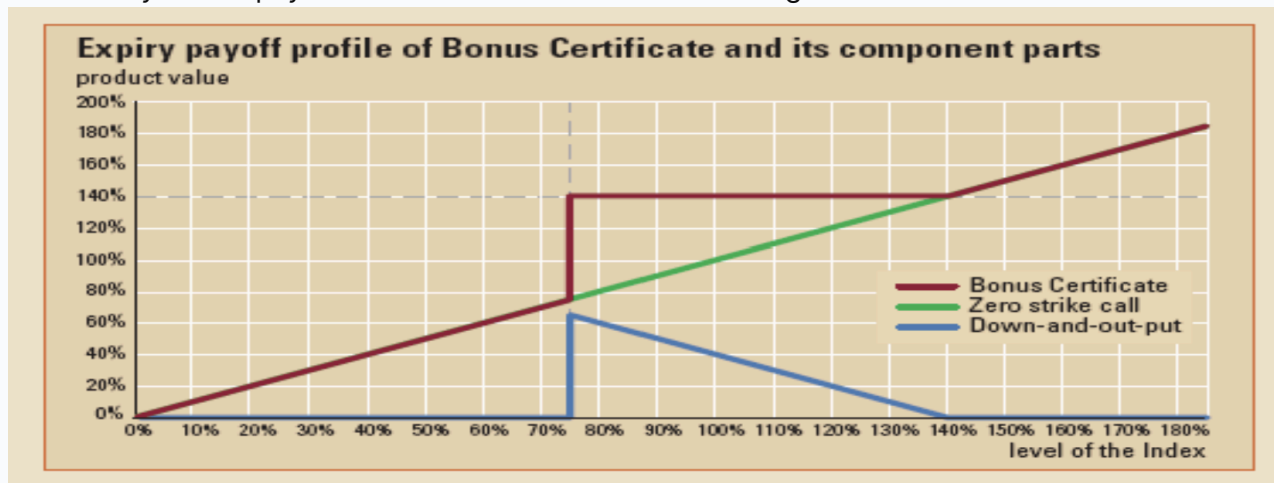
Bonus certificate on FTSE-100

Consider a BC on the FTSE-100 with maturity 3 years. At expiry a holder receives on his investment a return equal to

1. the FTSE-100 return (over the lifetime of the product) if it is the FTSE-100 ends above 140% of the initial level (at the start of the SP), or
2. a return of 40%, if the final level of the FTSE-100 is between 75% and 140% of the initial level, unless the index level has fallen below 75% of the initial level during the lifetime of the certificate in which case ...

3. one receives just the final level

A summary of this payout can be read off from the following chart



The BC is a combination of a zero-strike European call, i.e. an European call with strike equal to zero, and a Barrier option, more precisely a down-and-out barrier put (DOBP). Note that, the payout is not always better than a direct investment, because a BC doesn't pay dividends. These dividends are actually used to finance the DOBP. This makes high yield stocks/indices appealing to be used in BCs.

Boosters

Boosters

Boosters are a type of structured financial product designed to provide enhanced returns based on the performance of an underlying asset, typically within a specific range of outcomes. Unlike standard investments, boosters offer a leveraged exposure to the underlying asset's performance, allowing investors to potentially achieve higher returns than the direct investment in the asset itself. However, this leveraged exposure also comes with increased risk, especially if the asset's performance falls outside a predetermined range.

Key Features of Boosters

1. Underlying Asset:

- Boosters are linked to the performance of an underlying asset, such as a stock, index, commodity, or foreign exchange rate. The value of the booster is directly tied to the price movements of this underlying asset.

2. Leverage:

- One of the main features of boosters is the use of leverage. This means that for a given change in the price of the underlying asset, the booster amplifies the returns by a certain factor, often more than what would be obtained through a direct investment in the asset.
- For example, a booster with a leverage factor of 2 would provide twice the return (or loss) of the underlying asset's movement.

3. Cap or Maximum Return:

- Boosters often come with a cap or maximum return. This means that while the booster provides leveraged exposure to the underlying asset's performance, there is a limit to

how much the investor can earn.

- This cap is typically set to limit the issuer's exposure to extreme market movements, balancing the product's enhanced return feature.

4. **Capital Protection:**

- Some boosters offer partial or full capital protection, meaning that the investor is guaranteed to receive at least a portion of their initial investment back at maturity, regardless of the underlying asset's performance.
- The level of protection depends on the specific terms of the booster. However, not all boosters offer capital protection, and in such cases, investors may be exposed to the full downside risk of the underlying asset.
- Some boosters also have an asymmetric participation. The investor would be exposed to 100% of the losses but to a higher than 100% participation of the positive returns.

5. **Maturity:**

- Boosters have a fixed maturity date, typically ranging from a few months to several years. The final payout is determined at maturity based on the performance of the underlying asset and the specific terms of the booster.

How Boosters Work

1. **At Issuance:**

- An investor purchases a booster with a predefined leverage factor, cap on returns, and maturity date. The initial price of the booster is typically close to the price of the underlying asset or the nominal amount invested.

2. **During the Term:**

- The performance of the underlying asset is continuously monitored. The return of the booster is calculated by applying the leverage factor to the performance of the underlying asset, subject to any caps or limits on returns.

3. **At Maturity:**

- **If the Underlying Performs Well:** The investor receives a return based on the leveraged performance of the underlying asset, up to the cap. For example, if the underlying asset increases by 10% and the leverage factor is 2, the booster would provide a 20% return, assuming it is within the capped range.
- **If the Underlying Performs Poorly:** If the underlying asset's performance falls outside the range where the booster is profitable, the investor may lose money. The extent of the loss depends on the leverage factor and whether there is any capital protection.

Example of a Booster

Suppose a booster has the following terms:

- **Underlying Asset:** Stock ABC
- **Initial Price of ABC:** \$100 per share
- **Leverage Factor:** 2 (provides double the return of the underlying asset)
- **Cap on Returns:** 20%
- **Capital Protection:** 80% of the initial investment
- **Maturity:** 1 year

Scenarios at Maturity

1. Positive Performance within the Cap:

- If Stock ABC increases by 8% over the year, the booster with a leverage factor of 2 would provide a return of 16% ($8\% \times 2$), as this is within the cap of 20%.

2. Performance Exceeds the Cap:

- If Stock ABC increases by 15%, the booster with a leverage factor of 2 would ideally provide a 30% return. However, due to the cap on returns at 20%, the investor's return is limited to 20%.

3. Negative Performance:

- If Stock ABC decreases by 10%, the booster would result in a loss of 20% ($10\% \times 2$). However, with an 80% capital protection, the investor would receive 80% of the initial investment back at maturity, resulting in a total loss of 20%.

Structure of a tracker

The simplest example is a tracker where the investor tracks the performance of an underlying security for 100%, participating both in the upside and the downside.

Imagine the investor invests \$1000 into a structured note with such a payout. The payout function that is desired is then

$$1000 \cdot \frac{S(T)}{S(0)}$$

there are a few ways of structuring this:

Zero-strike call option

If we use a zero-strike call option, it is clear that the payout of this particular option is given by $\max(0, S(T) - 0) = S(T)$. So if we use the 1000 investment capital to purchase $A = 1000/(S(0))$ zero strike call options, we will have obtained a 100% participation.

Puts and calls and their parity

it is also clear that we

$$\max(S(T) - S(0), 0) - \max(S(0) - S(T), 0) = S(T) - S(0)$$

so that

$$1000 \cdot \frac{S(T)}{S(0)} = 1000 \cdot \frac{S(T) - S(0) + S(0)}{S(0)} = 1000 \cdot \left[1 + \frac{S(T) - S(0)}{S(0)} \right]$$

which looks identical to how we structured PPNs, but this time the payout of the option will be generated by buying calls and selling puts, in an amount of $A = 1000/S(0)$, we obtain the same structure as we discussed in the PPNs with a participation of 100%.

To summarize this approach, you would need to buy a ZCB, buy A calls and sell A puts.

Which one to choose?

Although the first approach seems much easier and from a theoretical point of view certainly is the preferred way of structuring the note, in practice this is not what would happen. Trading in derivatives is risky business, even for the most sophisticated investment banks. There are

plenty of examples where option positions were the root cause of investment banks losing a lot of money and in some cases even going under.

Therefore, from a credit perspective, spending all the investment money on a far in the money call (the zero strike call), is much riskier than allocating the principal into a zero coupon bond (which often is structured into a term account).

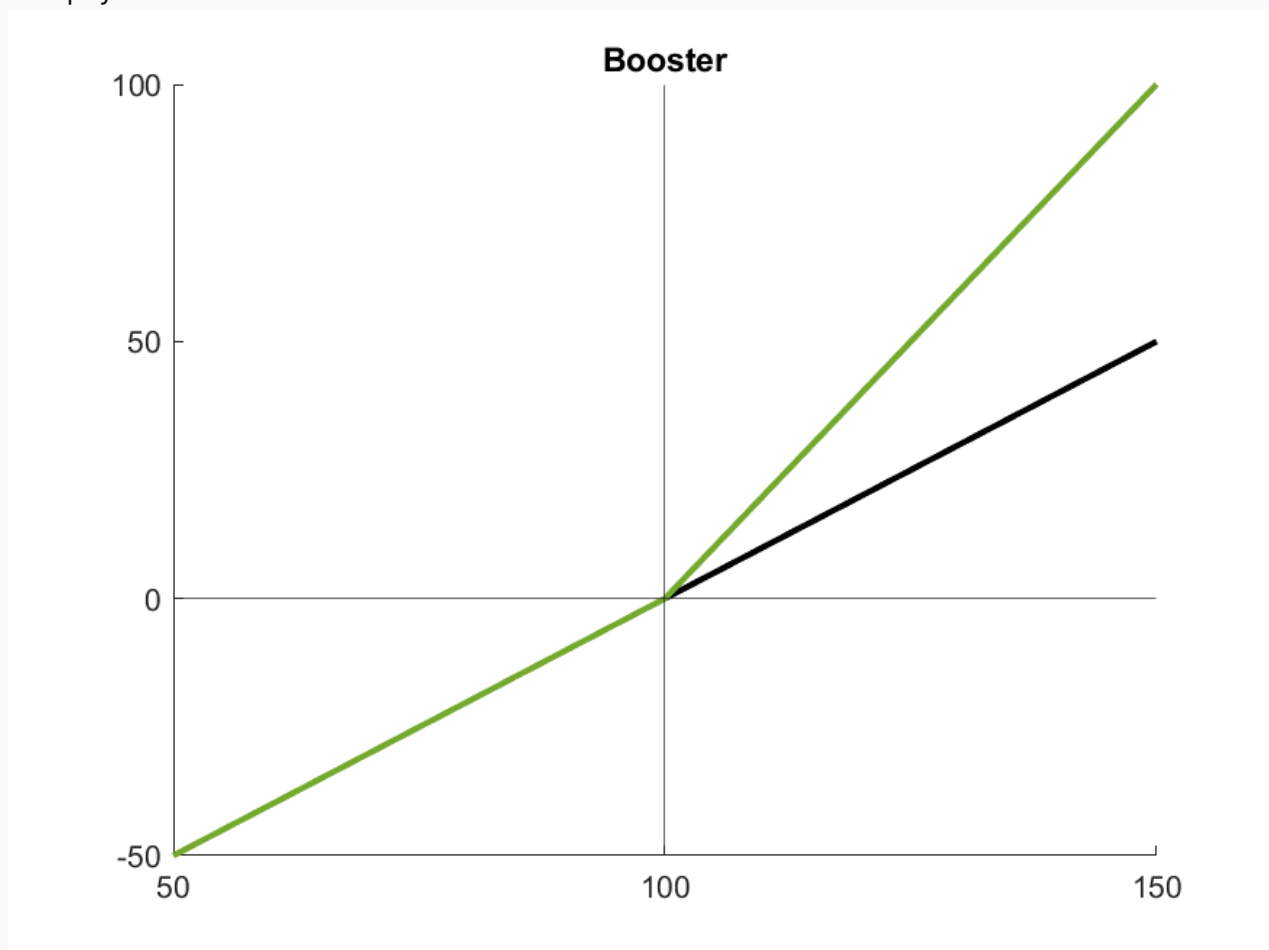
But for the purpose of easing down the theoretical arguments, we will most often refer to the zero-strike call option when we desire a tracker output.

Structure of a booster

Lets consider a simple booster that has:

- no capital protection,
- a participation rate of 150% if the underlying security gains in value, and
- a participation of 100% if the underlying security loses in value.

The payout function looks like this:



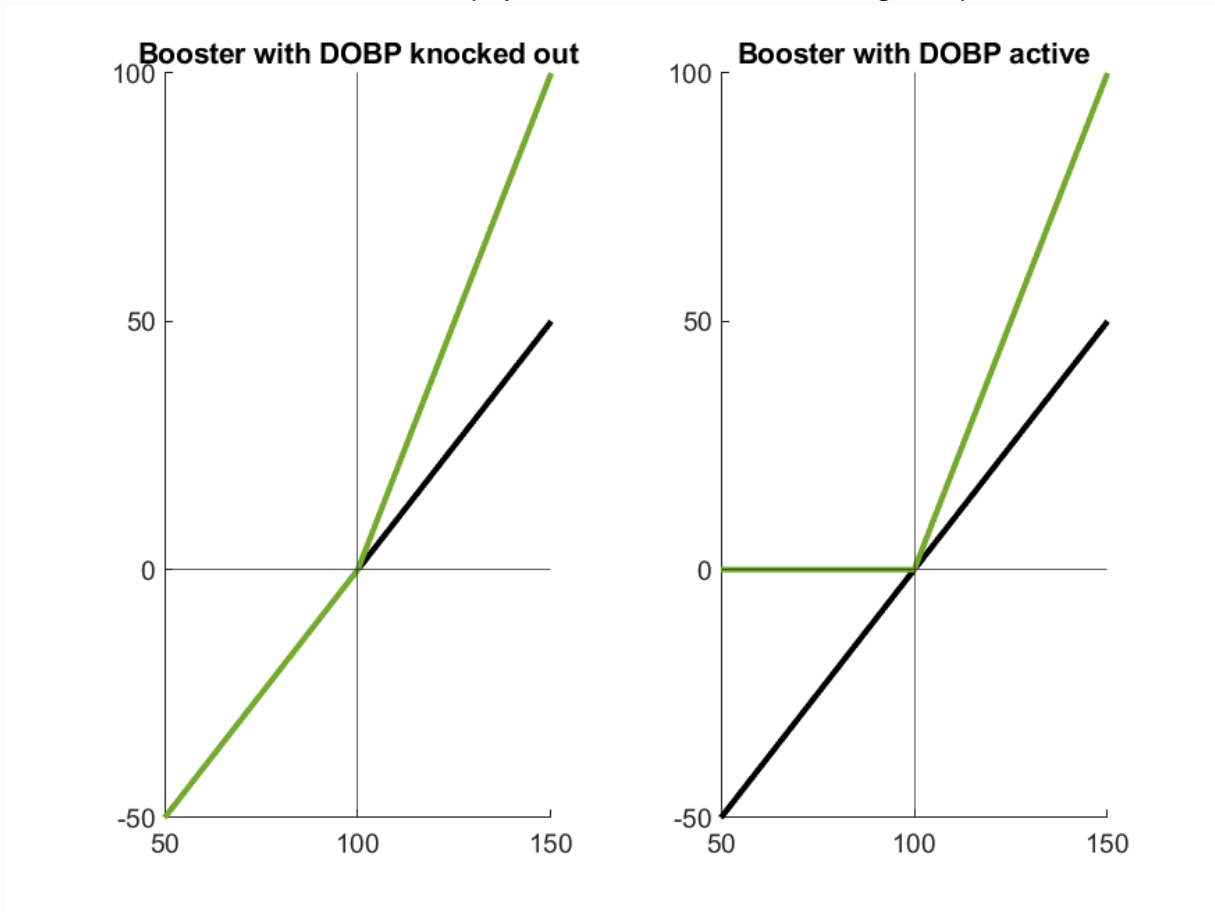
where in black, we can see the performance (y-axis in %) of the underlying versus the performance of the booster (green), both as a function of how the underlying moves (x-axis in %).

The black payout is the tracker output, which as we indicated above, can be structured by using zero strike call options. If we furthermore, purchase $1000/S(0)/2$ call options, then we obtain the booster payout (green).

Booster variation DOBP

One can add a barrier clause to the booster in the form of a DOBP:

- (right) if the underlying is always above the Barrier, then the Put option protects on the downside
- (left) if the barrier is breached, the payout is the same as in the regular (previous) booster.

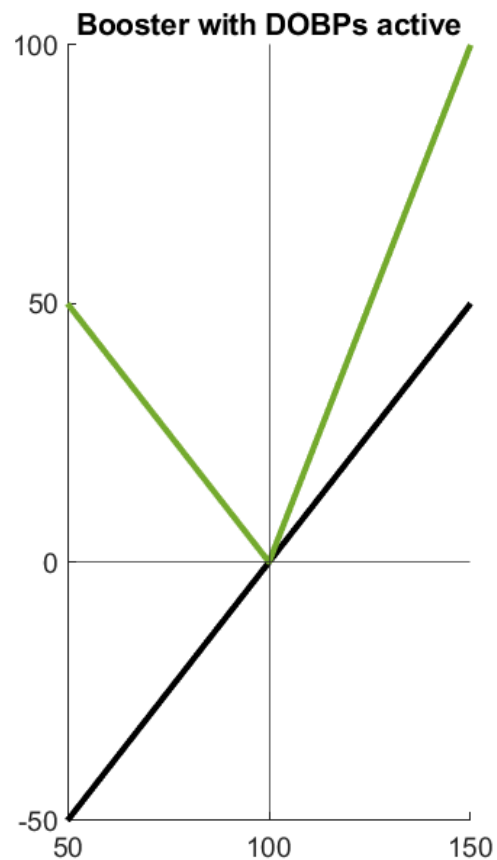
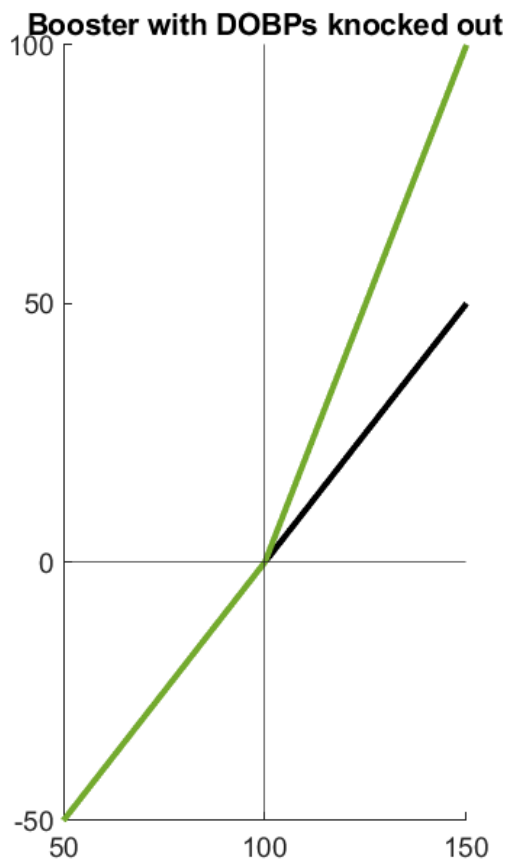


Note that even though the DOBP gives protection, it is only partial. Once the barrier is reached, the put becomes knocked out and does not come back. But by setting the barrier at psychologically low levels, the unsophisticated investor can easily be fooled into thinking the scenario is very unlikely.

Booster variation 2x DOBP

if we add another DOBP option in the mix, then we get the following structure:

- (right) if the underlying is always above the Barrier, then the first Put option protects on the downside whilst the second generates profits if the market drops.
- (left) if the barrier is breached, the payout is the same as in the regular (previous) booster.



Ladder structures

Ladder structures

A **structured note with a ladder structure** that involves **locking in gains once a certain percentage return is reached** is typically designed using **barrier options**, specifically **up-and-in barrier put options**. Here's how this type of structured note works:

Structured Note with Ladder Structure (Using Up-and-In Barrier Put Options)

1. Underlying Asset or Index:

- The note's performance is tied to an underlying asset, such as a stock, index, commodity, or currency.

2. Barrier Options:

- Up-and-In Barrier Put Options** are a type of barrier option that only comes into existence (is "knocked in") if the underlying asset reaches a certain level (the "barrier") above its initial price.
- Once the barrier level is reached, the put option is "in" and provides downside protection by allowing the holder to sell the asset at the strike price, even if the market value drops below this level.

3. Ladder Structure:

- The structured note is designed with a ladder mechanism, meaning it has several predetermined levels or "rungs" that the underlying asset must reach for gains to be

"locked in."

- Once a "rung" is achieved, the corresponding gain is locked, meaning the investor secures a minimum return regardless of future performance, subject to certain conditions.

4. Mechanism of Locking Gains:

- As the underlying asset's price rises and hits a predetermined barrier level, the corresponding up-and-in barrier put option is activated.
- This activation effectively locks in the gains at that level, as the put option now provides a form of downside protection, ensuring that any future losses beyond a certain point (defined by the put option's strike price) are mitigated.

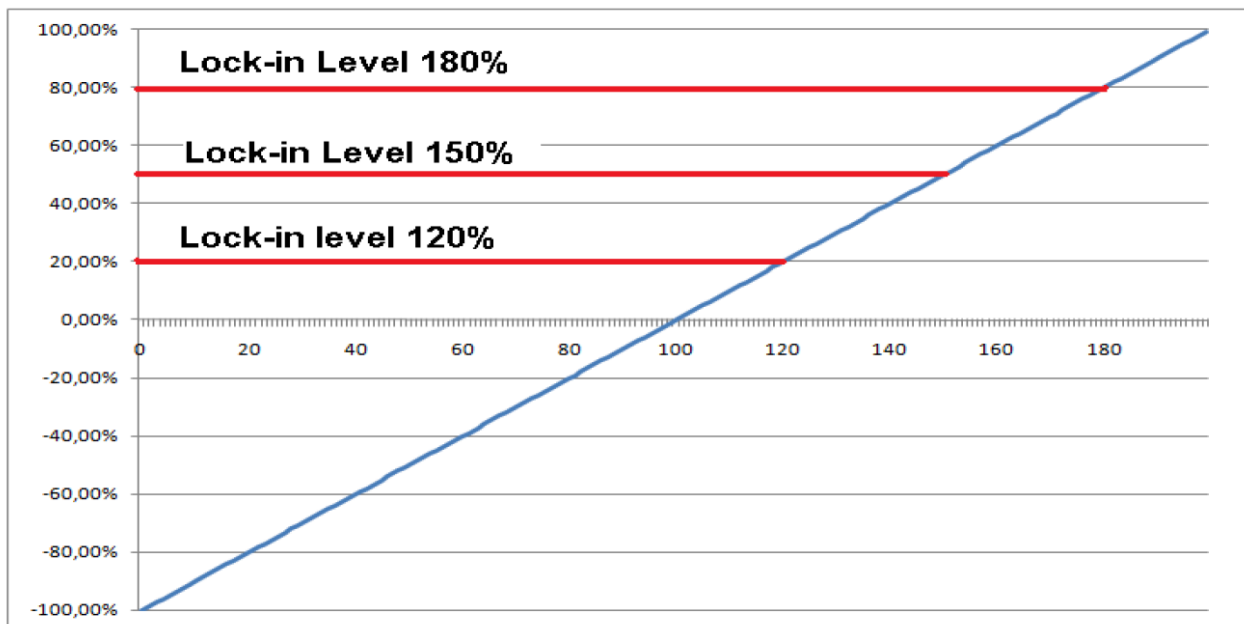
5. Potential Outcomes:

- If the underlying asset price increases and reaches the first barrier level, the gain is locked in. If the price then continues to rise and hits the next barrier level, the subsequent gain is also locked in, and so on, creating a "ladder" of locked-in returns.
- If the asset price falls after reaching a barrier, the investor is protected to the extent of the gains already locked in, minus any premium or cost associated with the options.

Simple example of a Ladder Structured Note

Consider a structured note linked to a stock index, like the S&P 500, with the following terms:

- **Initial Investment:** \$1,000
- **Underlying Asset:** S&P 500 Index
- **Barriers and Locked-In Levels:**
 - **Barrier 1:** 20% above initial level → locks in a 20% return
 - **Barrier 2:** 50% above initial level → locks in a 50% return
 - **Barrier 3:** 80% above initial level → locks in a 80% return
- **Maturity:** 3 years
- **Downside Protection:** Provided by up-and-in barrier put options activated when barriers are breached. But if those are not reached, no capital protection applies.



How to structure this note?

There are 3 components to this note:

- (long) Use a Zero-Strike call option to ensure the full participation in the underlying
- (long) A series of Up-and-In-Barrier Put options with the strikes equal to the barrier and at 120%, 150% and 180% to ensure locking in the performance
- (short) A series of Up-and-In Barrier put options with the strikes at 120% and 150% and the barriers respectively at 150% and 180%

We will go through the scenarios to explain this in more detail.

Scenarios

If the underlying always stays below the 120% barrier, then the structure is just a zero-strike call option, in other words it tracks the performance of the underlying security, both on the upside and on the downside.

If the underlying reached 120%, the Up and In Barrier put option kicks in with the strike at the 120%. This means that if the underlying drops below this level again, the put offers protection and they payout for the investor will be 20% at least. However, if the underlying keeps rising the investor will continue to benefit from this.

If we get to the next barrier, the same mechanism will kick in and the second put option will become available to offer better protection.

However, it is also clear to understand that if we then drop back to eg 110%, both options would be available and this is too much protection.

This is why we also have to include a component that sells a put option with strike 120% that becomes active when we reach the barrier of 150%. That way we get rid of the protection we no longer need.

If the market goes above 150% towards 180%, a similar combination is required.

Example of a Ladder Structured Note with Barrier Options

Consider a structured note linked to a stock index, like the S&P 500, with the following terms:

- **Initial Investment:** \$1,000
- **Underlying Asset:** S&P 500 Index
- **Barriers and Locked-In Levels:**
 - **Barrier 1:** 10% above initial level → locks in a 5% return
 - **Barrier 2:** 20% above initial level → locks in an additional 5% return (total 10%)
 - **Barrier 3:** 30% above initial level → locks in an additional 5% return (total 15%)
- **Maturity:** 3 years
- **Downside Protection:** Provided by up-and-in barrier put options activated when barriers are breached.

Scenarios

1. Scenario 1: Gradual Increase in Asset Price:

- **Year 1:** The S&P 500 index rises to 10% above the initial level. The first barrier is breached, activating the up-and-in put option. A 5% gain is locked in.
- **Year 2:** The index rises further to 20% above the initial level. The second barrier is breached, locking in an additional 5% gain. The total locked-in return is now 10%.
- **Year 3:** The index rises to 30% above the initial level. The third barrier is breached, locking in another 5% gain. The total locked-in return is 15%. At maturity, the investor receives the principal plus the 15% locked-in gain.

2. **Scenario 2: Volatile Price Movement:**

- **Year 1:** The S&P 500 index rises to 10% above the initial level. The first barrier is breached, locking in a 5% return.
- **Year 2:** The index falls back to its initial level. The up-and-in put option, which was activated, protects the 5% locked-in gain.
- **Year 3:** The index falls 15% below its initial level. Despite this decline, the 5% gain from Year 1 is still protected due to the up-and-in put option.