

**Untold Secrets of Structured Product
Investing
The Art of Mixing Profitable Financial
Cocktails in Any Market**

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Cocktails in Any Market**



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I have based my writing on my knowledge of finance theory as well as years of personal experience. The resulting contents of this book are journalistic and **not advisory**.

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Your research may include seeking out independent professional financial advice, which will be tailored to your circumstances, from a qualified individual.

This book is not a replacement for such advice. We do not purport to offer such a service, and we are not authorised by the Financial Conduct Authority (or any other authority) to do so.

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A theory that you can't explain to a bartender is probably no damn good.

— Ernest Rutherford

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Apéritif—Why Read this Book?

“

Never trust any complicated cocktail that remains perfectly clear until the last ingredient goes in, and then immediately clouds.



—Sir Terry Pratchett

Like Terry Pratchett, I would not want to drink a suspicious cocktail, the ingredients and level of alcohol of which were unknown to me. Likewise, I wouldn't want to invest my hard-earned money in some complicated investment product while understanding neither the purpose nor the risk profile of the investment.

This is why I decided to write a guide that takes a deep dive into the world of structured products investing—to explain their purpose, construction rules, and risk and performance profiles. This is the book where you will find many of the untold secrets of structured products—secrets usually known only to the expert traders who construct these products.

Just as you don't need to know how to mix a martini to enjoy one, you don't need to know any complex statistical formulas to get a great deal from this book. You should, of course, know that the likelihood for positive or negative returns is often described by probability distributions. For instance, you may want to keep in mind

the plot of the bell-shaped Gaussian distribution. Payoff charts and illustrations of the probability distribution of returns are powerful concepts that we will use in this book to illustrate the performance and risk characteristics of structured products.

Where I have introduced concepts, the first mention is in bold type, and you will find a full definition in the glossary.

In this book, I will explain the use cases of structured products, the way they are built (“product recipes”), and their risk and return profile in greater detail than what is available in material published by product providers or even in most textbooks.

At the same time, my goal is to make this book an entertaining read as well, by using the analogy of bar cocktails for structured products—a metaphor that works quite well in terms of explaining construction (“mixing”) rules, use cases, and risk profiles. This approach has also allowed me to add some anecdotes, which I hope you will enjoy, from the world of cocktails *and* the world of investing.

I have organised the book into three main parts that build on each other and increase in terms of technical complexity.

Part I: The Raison d’Être of Structured Products explains the basic definition of structured products, their use cases, and the four main product categories.

Part II: The Alchemy of Structured Products goes a bit more into technical details. Here, I will introduce technical concepts that help us to analyse the construction rules as well as the risk and performance profiles of structured products.

Part III: Deconstructing Structured Products is the part of the

book in which we will analyse construction rules and risk analysis for all commonly used structured products across the four standard product categories.

It is my genuine hope that you will find great value, and a bit of fun, herein. I welcome your feedback and questions. Please feel free to contact me on:

ggieseuk@gmail.com

To your health!



Part I.

The Raison d'Être of Structured Products

*Cocktails, chess, and structured products—what do they have in
common? Each requires a meticulous strategy.*

What Are Structured Products?



Drink nothing without seeing it; sign nothing without reading it.

—Spanish proverb

The easiest way to describe structured products is to compare them to something familiar. In the world of investing, structured products (“SPs”) play a similar role as cocktails do for visitors to a bar. When you purchase a cocktail at the bar, the bartender will mix a drink from basic ingredients (liquors, fortified wines, fruit juices, etc.) using a well-defined recipe. The resulting cocktail offers a complex flavour and an experience that feels richer than any of the individual ingredients.

In brief, a cocktail can be defined from two perspectives. From the perspective of the visitor to the bar, a cocktail is defined by its flavour and experience. However, from the perspective of the bartender, a cocktail is the result of a detailed technical recipe.

Structured products are very similar. They are linked to a basic underlying asset price (a stock price index, a commodity, or currency) but offer a more complex payoff (investment return) than a direct investment into the underlying asset. From the investor’s perspective, we can put it into a formal definition:

A **structured product** is a contract which the investor purchases from the product issuer for a fixed price at issuance, in which the issuer promises the investor a **payoff** at the product's maturity date, which is derived in a predefined way from the price of the underlying asset.

There are also some open-ended products (typically called “certificates”) that do not have a maturity date, but for the purpose of this book we will focus on products that have an issue date and a maturity date.

Let us return for a moment to the bartender's view of a cocktail: it is the result of a technical recipe. For structured products, this is the perspective of the product issuer who needs to know a recipe to build an investment portfolio that delivers exactly the product's promised payoff at maturity. This portfolio is called the “replicating portfolio of the structured product”. Let me put this into a more formal definition:

Replicating portfolio · A structured product is replicated by a pre-packaged investment portfolio of several of the following ingredients:

1. Basic tradeable assets, such as stocks, precious metals, currencies, and financial indexes or futures;
2. Fixed-income instruments (bonds, money market); and
3. Options on the above-mentioned assets.

A structured product has construction rules applied at issuance, defining:

1. The amount of capital invested in each component at issuance; and
2. The parameters of the ingredients (the strike and maturity of options, the coupon of bonds, etc.).

At maturity, the value of the replicating portfolio has to equal the promised payoff to the investor under any market scenario.

At first glance, the difference between a structured product and its replicating portfolio may be confusing. In fact, many books and product providers don't bother to define structured products as pre-packaged investment portfolios. When you order a cocktail in a bar, the bartender owes you only the final cocktail—not the ingredients, not the cocktail recipe. Likewise, the structured product issuer owes you only a final payoff at maturity—not the replicating portfolio.

All structured products discussed in this book meet the following consistency relations that ensure a meaningful product design:

- All options are on the same underlying asset as the structured product itself;
- Maturities of options and bonds are the same as the maturity of the structured product itself; and
- Strikes and barriers of options are set to the same respective levels as the structured product itself.

Unfortunately, the “bartenders” of the structured products world are typically not as transparent as the bartenders in a real-world bar, who let you watch the entire process of making the cocktail—it’s part of the cocktail bar experience. By contrast, structured product providers often sell products without disclosing the “secret” product recipe—and they don’t let you watch the trader compiling the product.

The purpose of the third part of this book is to secretly look over the shoulder of the structured products “bartender” to give you detailed insights into construction rules as well as risk and performance characteristics of structured products.

Listed Structured Products

For structured product providers, the replicating portfolio is not only important for earning the payoff of the product, but also for another reason: to define its price at issuance and during its lifetime. Structured products for retail investors are typically **listed** as securities at a stock exchange during their lifetime (i.e., from issuance to maturity). Therefore, the product provider acts as a so-called **market maker**. He offers investors the opportunity to buy more units of the product or to sell units of the product back to the provider at any point in time during its lifetime.

At what price can you buy and sell products? What is the fair value of a complex structured product during its lifetime? The answer is simple. The fair value of a product equals the value of its replicating portfolio at any given point in time T , which equals the sum of the value of its components:

$$\text{Product value}(T) = \sum_{\text{Components}} \text{Component Value}(T)$$

Hence, to act as a market maker, the product provider needs to set up the replicating portfolio in the trading system and observe its market value on a daily basis in order to quote the price at which he is willing to buy and sell the product at the exchange.

Typically, the bid price at which investors can sell the product back to the provider is the market value of the replicating portfolio minus a bid spread. And the ask price at which investors can buy units of the product is the fair value plus an ask spread. Just as for shares and bonds, the bid-ask spread is a reward for the market maker for offering to buy and sell at any given point in time, i.e., “to make

the market”. The spread between the bid price and ask price is an important indicator for investors how “liquid” the product is, i.e., how easy or how costly it is to buy and sell the product.

However, not all structured products are exchange listed: large investors often buy products directly from a product issuer, which are therefore called **OTC (over-the-counter)** products.

Settlement of Structured Products

Another important question regarding structured products is how they are settled, i.e., in what form the investor receives the payoff at maturity. Generally speaking, there are two types of **settlement**:

Cash settlement · A structured product is called cash-settled if the investor receives the product value in cash in the predefined settlement currency at maturity.

Physical settlement · A structured product is called physically settled if the investor receives the product payoff value at maturity in units of the product's underlying asset (e.g., in shares, gold, etc.).

This is a fundamental difference compared to cocktails in a bar: the bartender delivers you a “physical” cocktail that you can actually drink. By contrast, for a structured product, you may receive cash or physical units of the underlying asset as a final payment.

The difference between a cash settled and physically settled product is important for the product provider who has to choose a replicating portfolio for the product. As we will learn in Part III of this book, there may be different replicating portfolios delivering the same payoff—in bartender terms, there are different recipes for the exact same cocktail.

Product providers typically choose a replicating portfolio strategy that is aligned with the type of settlement. For instance, if the product is physically settled, then the replicating portfolio should be constructed in such a way that it delivers the quantity of the underlying asset proposed by the payoff, to be delivered to the investor at maturity.

Straight Up

Structured products are defined by two key elements:

- The product's contractually defined payoff at maturity, which is a predefined function of one or several underlying asset prices; and
- A replicating portfolio, which delivers the promised payoff at maturity regardless of the development of the underlying asset price.

In addition, it is essential to remember that:

- Structured products for retail investors are typically listed on a stock exchange, where the product provider acts as market maker, offering investors the opportunity to buy or sell units of the product during its lifetime.
- The value of a structured product during its lifetime is essentially defined by the value of its replicating portfolio.
- Exchange-traded products typically have a bid and an ask price for selling and buying the product, which surround the fair value of the product as defined by its replicating portfolio.
- Products can be settled at maturity either in cash or in units of the underlying asset.



What Payoffs Do SPs Offer?



The greatest accomplishment of a bartender lies in his ability to exactly suit his customer.

—Harry Gordon Johnson

Bartenders understand the different types of flavours and levels of alcohol they can achieve with cocktails. In the language of structured products, investors have to understand the types of payoffs one can create and what advantages they offer compared to a simple investment in the underlying asset of the product.

At a high level, structured products offer four types of flavours (payoffs) that a simple investment in the underlying cannot produce: *leverage*, *short*, *convexity* and *concavity*. We will look at the returns that these flavours produce in more detail.

Let's take a closer look at the first type of payoff, which is leverage. In cocktail terms, leverage means to “strengthen” a cocktail by adding more alcohol. In financial terms it means:

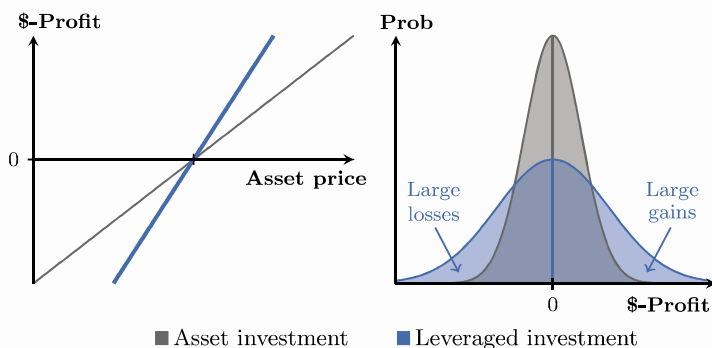
Leverage · Leverage means that the product payoff *amplifies* price moves of the underlying asset: when the underlying asset moves by 1%, the price of the structured product moves by more than 1%.

Highly alcoholic cocktails can be great fun, but can also lead to a terrific hangover. Likewise, leveraging your investment goes both ways: it increases profits on the upside, but also increases losses on the downside.

Figure 1 depicts the concept of leverage in detail. The left graph shows the profit of a leveraged product as a function of the underlying asset price versus an investment in the underlying asset. The leveraged payoff line is steeper, indicating stronger gains on the upside as well as bigger losses on the downside. This is also reflected in the stretched probability distribution of profits shown on the right. The leveraged payoff line is steeper, indicating stronger gains on the upside as well as bigger losses on the downside. This is also reflected in the stretched probability distribution of profits shown on the right.

Leverage means to steepen the payoff and to stretch the probability distribution, increasing the likelihood of large gains or losses.

Figure 1. The concept of leverage



Profit (left) and probability distribution for profits (right) of a direct investment in the asset and a leveraged investment.

You may ask the question whether the degree of leverage may also be negative. The answer is yes, it's called a "short position" and is effectively our second payoff "flavour". In bartender terms, "shorting" means *owing* somebody a cocktail.

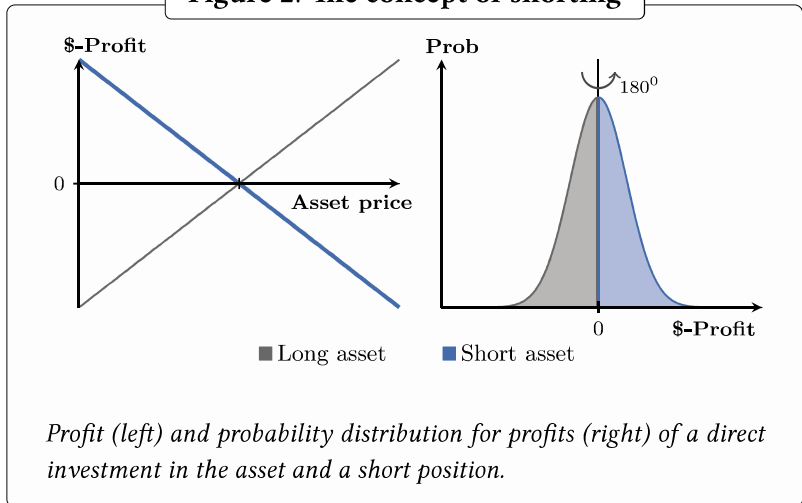
In financial terms, we can define it like this:

Short · Short means that the value of your investment moves inversely to the value of the underlying asset.

A **short position** enables you to profit when the asset price is falling. However, this goes both ways: if the price of the asset rises, a short position will create a loss. For the sake of completeness, it is worth mentioning that a direct investment into the asset is often referred to as a **long position**.

Figure 2 illustrates the difference between long and short positions in a payoff diagram. A long position has an upward sloping pay-off line, a short position has a downward sloping payoff chart. The probability distribution of the short position is effectively the vertical mirror image of the profit distribution of the underlying asset, as indicated on the right-hand side in Figure 2.

Figure 2. The concept of shorting



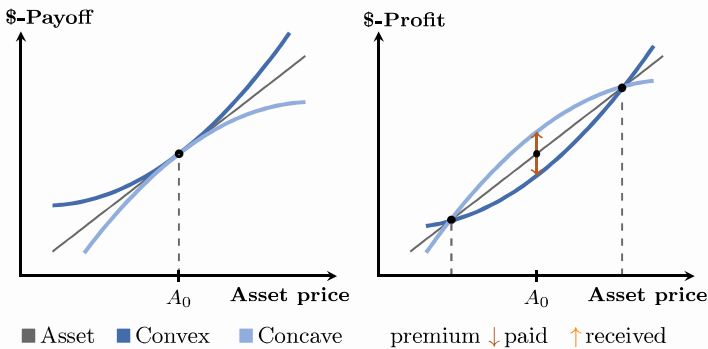
Shorting means to invert the slope of the payoff and to flip the profit probability distribution vertically.

Returning to our bartender's work, there are two more flavours he can use for his cocktails, i.e., he can add sweet or sour flavours. In the financial world, the equivalent to sweet and sour are the concepts of convex and concave payoffs.

Convexity · Convexity is a payoff feature that offers an advantage over investing in the underlying asset. The convex payoff stays above the payoff of the asset for both up and down moves of the asset price. Therefore, investors need to pay a premium to the payoff provider for obtaining this advantage.

Figure 3 shows the advantage of a convex payoff on the left. On the right it shows the resulting profit after taking into account the premium investors have to pay for obtaining a convex payoff.

Figure 3. The concept of convex and concave payoffs



Payoff and profit and loss (=payoff minus/plus premium paid or received) for convex and concave payoffs (A_0 = current asset price).

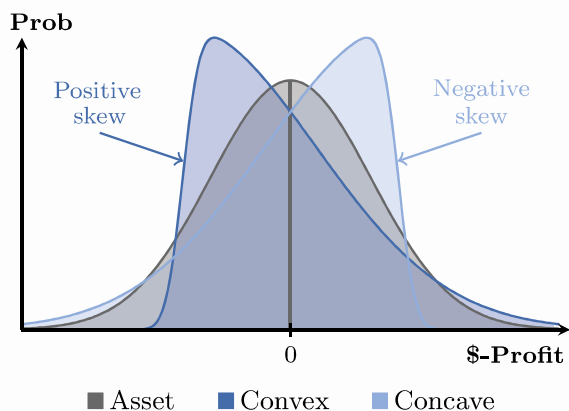
Convexity means to add positive curvature to the payoff, concavity means to add negative curvature to the payoff.

The flip-side of convex payoff is a concave payoff, which is our fourth payoff “flavour.”

Concavity · Concavity means the product’s return remains below the payoff of the asset for both up and down price moves. Therefore, investors receive a discount when purchasing the product from the issuer for accepting the relatively lower payoff.

For both convex and concave payoffs, the resulting \$-Profit is the sum of the payoff and the premium paid or received, as shown on the right-hand side in Figure 3. Consequently, the concave product has an overall better profit for small movements in the underlying price (between the dashed lines), while the convex profit is better for large movements.

The difference between a direct investment in the asset, a concave payoff, and a convex payoff is also reflected in the probability distribution of potential profits and losses illustrated in Figure 4.

Figure 4. Probability distribution of different payoffs

Profit probability distribution of convex and concave payoffs with identical mean and volatility compared to the asset price.

Convexity leads to an upward skew in the profit probability distribution; concavity leads to negative skew.

Convex payoffs have a relatively high probability of making a small loss but at the same time have a relatively high probability of delivering significant out-performance over the asset when the underlying moves substantially. By contrast, *concave payoffs* have a relatively high probability of making a small profit, but there is also a relatively high risk of under-performance. Convex and concave payoffs are also called **non-linear payoffs**, while the aforementioned long and short positions are **linear payoffs**.

Concave products typically offer an advantage when markets go sideways and therefore an investment in the underlying asset itself does not offer returns. On the other hand, investors in convex products usually do best compared to an investment in the underlying asset when the underlying price moves substantially.

Please note: In this book we provide simplistic qualitative illustrations of how structured products change the probability distribution of the underlying asset by stretching, flipping, or adding skew to the distribution. We assume a simple bell-shaped distribution for the underlying asset. In practice, the exact form of assets' probability distribution may be more complex than a simple bell-shaped curve and may differ across assets and across different market environments.

It is important to note that the effects that we highlight in this book—how a structured product's payoff changes the return distribution of the asset during the product's lifetime—will be valid across different shapes of distributions for the underlying asset.

It is also important to mention that in practice, structured products can *combine several of these four flavours in one product payoff*. You can have a leveraged short payoff or a payoff that is partially concave and partially convex, as we will see.

Overall, the key advantage of structured products is that you can choose a payoff flavour for every *expected* market situation—a short payoff when you expect falling markets, a concave payoff when you expect markets going sideways, a convex payoff when you expect large upswings or downswings in market prices or a leveraged payoff if you are very bullish. When your expectation turns out to be right, you will make more money than you would have made investing in the underlying asset.

To conclude, structured products are a toolkit for tactical asset allocation, making investments in response to the prevailing market environment, based on short- to medium-term market expectations.

There is another lesson to be learned from the discussion of the four payoff flavours. Every advantage you get from a specific payoff

needs to be paid for, which is *the fundamental* rule of structured products investing: I call it the *No Free Lunch Rule*. Nevertheless, during its lifetime a structured product may outperform its underlying asset, provided you choose the right payoff flavour.

No Free Lunch Rule

At issuance, no structured product makes an investor unconditionally better off than a direct investment in the underlying asset. The investor has to pay for every additional opportunity over investing in the asset —e.g., a convex payoff—by paying a premium or by accepting a disadvantage in another market scenario. Likewise, the investor is compensated for forgoing opportunities—e.g., a concave payoff—by price discounts or by receiving an upside in a different market scenario.

Straight Up

Structured products are a *toolkit for tactical capital allocation* and offer four investment flavours for different market situations:

- Leverage enables you to amplify profits and losses of the underlying asset—it means steepening the payoff curve and stretching the probability distribution of profits.
- Shorting allows you to profit from falling asset prices—it means inverting the slope of the payoff curve and flipping the probability distribution of the underlying asset vertically.
- Concavity delivers returns when markets go sideways—it means adding negative curvature to the payoff chart and adding a downside skew to the probability distribution of profits.
- Convexity offers the opportunity to profit in markets showing huge downswings (capital protection) or upswings—it means adding positive curvature to the payoff chart and upside skew to the probability distribution of profits.

Also, let's remember the limitations and potential risks:

- *There is no free lunch.* You have to pay for every additional opportunity and you get paid for skipping opportunities.
- Structured products can lead to larger gains than a direct investment in the underlying asset, but also to larger losses, depending on whether your market expectations at the time you choose your payoff were right or wrong.



What Are the Main Categories?

“

There are few professions whose primary objective is to advance the cause of humanity rather than simply to make money or accrue power. Among this limited group of humanitarians I would number teachers, nurses, bookstore owners, and bartenders.





—Jack McDevitt

It is not enough to know the different flavours one can achieve with cocktails—a great bartender needs to master the different cocktail recipes to achieve these flavours with aplomb. The same holds for structured products: in the previous section we explained the four payoff “flavours”—leverage, short, convexity, concavity—as theoretical concepts. Now, it is time to see how these payoff concepts can be accomplished through different categories of structured products.

Again, it turns out that the world of structured products is similar to the world of bar cocktails. While there are many cocktail recipes, most of them can be described as modifications of one of five traditional basic bar cocktails, which define the five traditional cocktail categories: ancestrals, sours, highballs, spirit-forwards and complex sours, which I have summarised in Figure 8 for cocktail-thirsty readers as an appendix to this section.

Similar to the five standard bar cocktail categories, structured products can be categorised into *four* main product categories shown in Figure 5. They are called capital protection, yield enhancement, participation, and leverage. These four categories achieve the four aforementioned payoff “flavours”—convexity, concavity, long/short as well as leverage.

Figure 5. Basic categories of structured products

Category	Description
Protection 	Capital protection products are the standard type of convex products, which use options to buy downside protection on the underlying asset. Often some of the upside is given up to finance the protection, e.g., by implementing a cap on the upside. Products can offer full or partial downside protection.
Enhancement 	Yield enhancement products “enhance” the interest rate return of a bond by selling options. As concave products, they are suited for investors who want to use premia from selling options as additional income. Examples are the discount certificate and the reverse convertible .
Participation 	Participation products allow the investor to take a long position or short position in the underlying asset through tracker certificates. There are also more complex products that add a non-linear element to the payoff, such as the bonus certificate or the twin-win certificate .
Leverage 	Leverage products amplify the return of the underlying asset and therefore offer higher potential upside to investors who are willing to accept higher levels of risk. Simple versions are call and put warrants or mini-futures, but there are also more complex products such as constant leverage certificates or spread warrants .

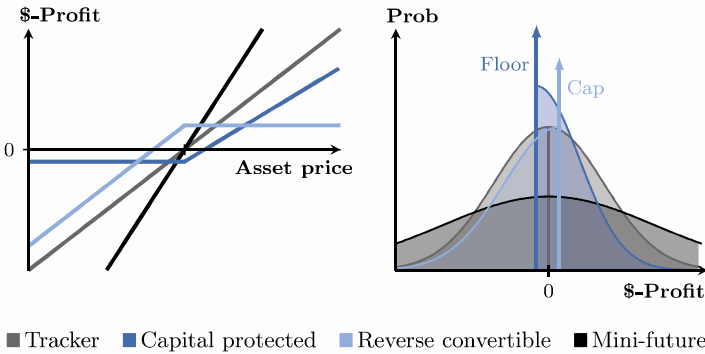
A bartender organises his drinks, mixers, and garnish so that he can efficiently make drinks. Likewise, systematically categorising structured products into main product categories can help investors to find their way through a wide range of products. Many national structured product associations have issued guidelines that help investors understand the various categories and the related risk profiles. For instance, the Swiss Structured Products Association maintains a comprehensive categorisation of structured products in its

Swiss Derivative Map, which you can find on its website.¹ This derivative map is the equivalent of a bar cocktail menu.

To understand the basic investment idea of each product category, look at a typical example product that illustrates the type of payoff of its category. In Figure 6 we chose the capital-protected certificate, the reverse convertible as a typical yield enhancement product, the linear tracker certificate—which exists in a long and short version—as a typical participation product and the mini-future as a leverage product.

We also observe the typical impact on the profit probability distribution: the convex capital protection product has a right-skewed profit distribution with a probability spike indicating the protection level; the concave reverse convertible results in a left-skewed distribution with a probability spike at the upper cap level—it results from selling a put option; the linear tracker shows the same distribution as the underlying asset; and the leverage product results in a proportionally stretched distribution. We will discuss these products in detail in the following chapters.

¹The 2020 report is available at https://sspa.ch/wp-content/uploads/2020/09/map_en.pdf. Alternatively, visit <https://www.svsp-verband.ch/en/> and click on Derivative Map.

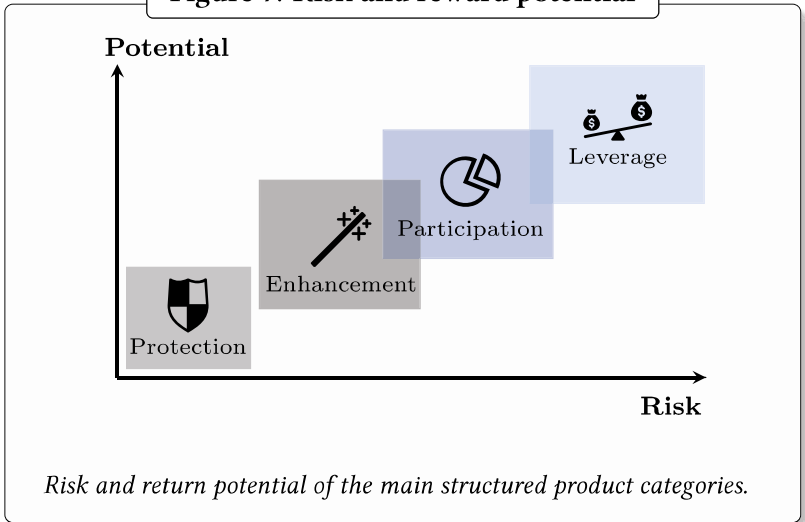
Figure 6. Characteristics of four product categories

Left: Stylised payoffs of four product categories at maturity. Right: the corresponding probability distribution of profits.

These four product categories are very different in terms of both potential gains if markets go in the expected direction and potential losses if markets go in the opposite direction. The risk for suffering losses for each type of product can be directly derived from its payoff.

To give a more holistic overview across product categories, many product providers illustrate these four product categories in increasing order of their financial risk in a stylised risk vs. potential for profits chart, as shown in Figure 7.

Figure 7. Risk and reward potential



However, it is usually not sufficient to assess the risk of a product (i.e., its potential for financial losses) solely based on its product category.

Within each product category, there are multiple types of products with varying levels of risk. Therefore, in practice these four categories overlap in terms of their risk profile, as illustrated in Figure 7. For instance, a relatively risky yield enhancement product (e.g., a worst-of reverse convertible) may expose investors to more downside risk than a relatively safe participation product.

In addition, one should not only assess the riskiness of a product in terms of potential financial losses, but also in terms of its level of complexity and transparency. You should be able to understand the product's payoff in any given market scenario.

Therefore, it is critical to assess the risk profile of each individual product before investing.

Straight Up

There are four main categories of structured products, which are often presented in increasing order of financial risk.

- Capital protection products, which incorporate a convex payoff by buying options as part of the product design. The typical and simplest representative of this category is the capital-protected certificate.
- Yield enhancement products, which use a concave payoff for bond investors who have the risk appetite to enhance the coupon of the bond by selling options. The typical and simplest representative of this category is the reverse convertible.
- Participation products, which utilise a long or short position in the underlying asset, potentially with some additional non-linear twists. The typical and simplest representative of this category is the tracker certificate.
- Leveraged products, which offer a leveraged payoff for investors seeking amplified returns on the underlying asset and with high risk appetite. The simplest representative of this category is the mini-future.

Keep in mind that within each category you will find products with different levels of financial risk and different levels of payoff complexity.



Figure 8. Classic cocktail categories



The old fashioned is the prototype of Victorian times stirred cocktails or **ancestrals**: spirit forward, boozy drinks, typically containing a base spirit, a sweetener, and modifiers such as bitters, liqueurs or fortified wines, served up or on the rocks. Another famous example is the sazerac.



The whiskey sour is the prototype of **sours**: shaken cocktails composed of something acidic (e.g., citrus juices), sweetener (usually syrup), and typically a strong base spirit, though fortified wines or liqueurs are often included. Sours can be served up or on the rocks. Another example is the daiquiri.



The Tom Collins is the prototype of **highballs** or “long” drinks: usually a sour or stirred base lengthened by the addition of carbonated water, served in a tall glass over ice. The base may be shaken before the addition of carbonated water and stirred to combine. Examples include the Pimm’s Cup, Presbyterian and the Dark and Stormy.



The Negroni is the prototype of **spirit-forwards**: an innovation of the 1880s when fortified wines (vermouth, sherry, quinquina or port) were mixed into ancestrals, often accompanied by bitters or small doses of liqueurs or syrups, typically prepared by stirring the mixture with ice and served straight up (not on the rocks). Examples are the martini, the Manhattan, the Bijou and El Presidente.



The sidecar is the prototype of **complex sours**, a subcategory of sours, in which the sugar is substituted in whole or in part by syrups, liqueurs or fortified wines. Examples include the clover club, the margarita, the corpse reviver nr. 2, the last word and the cosmopolitan.