

**MASTER
FINANCE**

**MASTER'S FINAL WORK
PROJECT**

VALUATION AND RISK PROFILE ANALYSIS OF THE FIXED
COUPON EXPRESS CERTIFICATE LINKED TO EURO
STOXX 50 INDEX

JOÃO PEDRO PERALTA ROXO

JUNE - 2023

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SUPERVISION:

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GLOSSARY

B – Barrier

CF – Cash-Flow

DIP – Down-in Put

EL – Expected Life

GBM – Geometric Brownian Motion

K – Strike

KID – Key Information Document

RRA – Risk Relative Averse

RTF – Risk Tolerance Function

UND_M – Underlying at Maturity

ABSTRACT

This project aims to increase knowledge about structured financial products, carry out a valuation of a structured product and understand which type of investors are more likely to invest in a structured product.

In this work, is carried out a valuation of a structured product issued by Deutsche Bank in 2020, the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, through a Monte Carlo simulation. It is also carried out an analysis of the risk profile of investors who tend to invest in similar structured products, through the use of a risk tolerance function, obtained from a 2nd order Taylor approximation, establishing a comparison between the structured product and other investment alternatives, in order to verify the preferences of investors with different risk tolerances.

Regarding the valuation of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, are used three different volatility levels, and when the level of volatility that is established as reference is used, the product that is being studied becomes slightly overvalued.

In the analysis of the risk profile of investors, it is possible to conclude that investors who are more willing to take risks tend to prefer investing in the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in relation to a considerable part of the other chosen financial products, and are more willing to invest in the studied product in comparison to risk-neutral and risk-averse investors.

KEYWORDS: Structured Product; Monte Carlo Simulation; Risk.

JEL CODES: G11; G12; G17.

RESUMO

Este projeto tem como propósito aprofundar o conhecimento sobre produtos financeiros estruturados, realizar uma avaliação de um produto estruturado e perceber que tipo de investidores são mais propícios a investirem num produto estruturado.

Neste trabalho, é realizada uma avaliação de um produto estruturado lançado pelo Deutsche Bank em 2020, o Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, através de uma simulação de Monte Carlo. É também efetuada uma análise ao perfil de risco dos investidores que tendem a investir em produtos estruturados semelhantes, através da utilização de uma função de tolerância de risco, obtida através de uma aproximação de 2ª ordem de Taylor, estabelecendo uma comparação entre o produto estruturado e outras alternativas de investimento, de modo a verificar as preferências de investidores com diferentes tolerâncias ao risco.

No que toca à avaliação do Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, são utilizados três níveis de volatilidade diferentes, sendo que quando é usado o nível de volatilidade que é estabelecido como referência, o produto alvo encontra-se ligeiramente sobrevalorizado.

Na análise ao perfil de risco dos investidores, é possível concluir que os investidores que estão mais dispostos a assumir riscos, tendem a preferir investir no Fixed Coupon Express Certificate linked to EURO STOXX 50 Index relativamente a uma parte considerável dos outros produtos financeiros escolhidos, e estão mais dispostos a investirem no produto estudado em comparação com os investidores neutros ao risco e aos mais avessos ao risco.

KEYWORDS: Produto Estruturado; Simulação de Monte Carlo; Risco.

JEL CODES: G11; G12; G17.

TABLE OF CONTENTS

Glossary.....	i
Abstract.....	ii
Resumo.....	iii
Table of Figures.....	iv
Table of Tables.....	v
Acknowledgments.....	vi
Agradecimentos.....	vii
1. Introduction.....	1
2. Literature Review.....	2
2.1. Investment in Structured Products.....	2
2.2. Autocallables.....	3
3. Data and Methodology.....	4
3.1. Data.....	4
3.2. Methodology.....	5
3.2.1. The product.....	5
3.2.2. Pricing Model.....	6
3.2.3. Risk Profile Analysis.....	9
4. Results – Valuation.....	10
4.1. Volatilities.....	10
4.2. Probability Analysis.....	11
4.3. Cash-Flow Map.....	13
4.4. Conditional Probabilities.....	15
4.5. Payoff Distribution in 2025.....	17
4.6. Valuation.....	21
4.7. Lifespan of the product.....	22
5. Results – Risk Profile Analysis.....	23
6. Conclusion.....	30
7. References.....	31
8. Appendices.....	32

TABLE OF FIGURES

Figure 1 – Annualized Volatility over Log Returns using Moving Standard Deviation..	11
Figure 2 - Payoff distribution in 2025 ($\sigma = 12.78\%$) if the product terminates in 2025..	18
Figure 3 - Payoff distribution in 2025 ($\sigma = 12.78\%$) if the product terminates in 2025 below the barrier.	18
Figure 4 - Payoff distribution in 2025 ($\sigma = 7.01\%$) if the product terminates in 2025....	19
Figure 5 - Payoff distribution in 2025 ($\sigma = 7.01\%$) if the product terminates in 2025 below the barrier.....	19
Figure 6 - Payoff distribution in 2025 ($\sigma = 29.25\%$) if the product terminates in 2025..	20
Figure 7 - Payoff distribution in 2025 ($\sigma = 29.25\%$) if the product terminates in 2025 below the barrier.	21
Figure 8 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with the same product but with different barriers.	24
Figure 9 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with the EURO STOXX 50 Index	25
Figure 10 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different classes of bonds	27
Figure 11 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different Real Estate financial instruments.	28
Figure 12 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different classes of commodities.	29
Figure 13 – Page 1 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.	32
Figure 14 – Page 2 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.	33
Figure 15 - Page 3 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.	34

TABLE OF TABLES

Table I - Probability Analysis (Volatility = 12.78%)	12
Table II - Probability Analysis (Volatility = 7.01%).....	12
Table III - Probability Analysis (Volatility = 29.25%)	12
Table IV - CF Map (Volatility = 12.78%).....	14
Table V - CF Map (Volatility = 7.01%).....	14
Table VI - CF Map (Volatility = 29.25%).....	15
Table VII - Conditional Probabilities (Volatility = 12.78%)	16
Table VIII - Conditional Probabilities (Volatility = 7.01%).....	16
Table IX - Conditional Probabilities (Volatility = 29.25%).....	17
Table X - Product Valuation	22
Table XI - Expected lifespan of the product.....	23
Table XII - The Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with different barrier levels	24
Table XIII - EURO STOXX 50 Index	25
Table XIV - Government and Corporate Bonds.....	26
Table XV - Real Estate Financial Instruments	27
Table XVI - Commodities	28

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1. INTRODUCTION

This project started with an analysis to a structured product, provided and requested by Professor João Duque to me and my group colleagues in the Financial Engineering course, which took place in the 1st semester of the 2nd year of the Master in Finance.

The product provided to us is the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index and the objective of this project is to carry out a valuation of the product and analyze the type of investors that have a higher tendency to invest in structured products, taking as an example the structured product that was assigned to us.

This work has a particular importance, since structured products are not commonly known by a large part of the population and those who have heard about them often do not know them in depth.

In addition to exploring the unknown and trying to provide to the readers of this project more knowledge about this kind of products, the objectives are also to make a valuation of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, in order to try to apply concepts that appear on the literature to price these complex products and understand their relevance as a financial instrument to the investors and to the institutions that issue them, such as whether it is an attractive investment vehicle for investors, and what type of investors prefer or not prefer them compared to other financial instruments available in the market.

The valuation and analysis carried out on the product consisted in an analysis of volatilities, and based on a Monte Carlo simulation, probabilities and payoffs were analyzed and was presented a value proposition for the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

The analysis regarding the type of investors, who prefer or not, the structured product assigned to us in comparison to other alternative financial instruments was executed by comparing the risk tolerance functions (RTFs), resulting from a second-order Taylor approximation, of our product and of the other financial alternatives that are chosen.

2. LITERATURE REVIEW

Structured products are complex financial instruments that are created through the combination of multiple financial assets into a single investment product.

These products have gained significant attention in the financial industry as complex investment vehicles that offer customized risk-return profiles to investors.

Understanding the characteristics, benefits, and risks associated with structured products is crucial for investors and financial professionals, but especially for retail investors.

This section is divided between two subsections. Subsection 2.1 discusses what drives investors to buy structured products and Subsection 2.2 addresses the current state of autocallables.

2.1. INVESTMENT IN STRUCTURED PRODUCTS

The structured products are having success in the last years, and this success raises the question of whether their issuers provide a benefit for retail investors capable of compensate the significant costs that are charged to these investors.

According to Hens & Rieger (2011), the large demand for these products can be explained by the fact that investors, with prospect theory utility functions, might perceive substantial utility gains from structured products, or through behavioral factors, such as systematic probability misestimation. In conclusion, the authors defended that “the market for structured products (a highly profitable business for banks) offers mostly illusionary benefits for investors”.

Ofir & Wiener (2012) argue that many structured products available to retail investors are designed to make the most of behavioral biases, such as “loss aversion, the disposition effects, herd behavior, the ostrich effect and the hindsight bias”, and because of that these authors defend heavier regulation concerning structured products to improve investor protection.

Fischer (2007) defends that most of the investors of structured products show motives of rational investment, such as diversification and cost reduction, but there is still a significant part of investors that shows irrational strategies, that is related with a higher risk attitude and their own investment activity (lack of diversification of assets and trading too much).

To fight the irrational strategies, Fischer (2007), suggests financial advice, as it “has a positive effect on investment strategies of individual investors”.

2.2. AUTOCALLABLES

Regarding autocallables, Albuquerque et al (2015) states that the autocallables have received a lot of attention due to the high coupons (in low-yield environments) that they provide to the investors.

There is reluctance by the financial advisers to promote this type of products to retail investors, because of the association that is often done between their high yields and their complexity.

The autocallables are structured products built with underlying assets, that according to Albuquerque et al (2015) “do not appear to choose underlying assets in a random fashion or to issue these securities at random times: the underlying security displays high volatility and generally performs well in the stock market, displaying prices at or near the 52-week high value.”

So, this recent attention to the autocallables by the investors might be justified by the investors' views on the underlying assets that compose the autocallables, regarding its price and volatility over the time.

According to Sie & Helmersen (2021), by analysing two autocallable structured products issued by Goldman Sachs, they suggest that the issuer, the facilitator and the distributor, of these structured products, benefit on behalf of the investors, once they claim that these products were extremely overpriced and that the probabilities of the investors ending up with negative returns was higher than ending up with positive returns.

Finally, they argue that these structured products have biased supporting documents, and that there is a lack of important information about them, with this being harmful to the investors.

We know that autocallable structured products are composed by underlying assets, and that the value of these kind of products depend on the performance of these assets.

Wårhag & Tepes (2020), using a sample of 30 structured products, followed an ordinary least squares regression model, to find that not only the return of the underlying assets have a statistically significant effect on the returns of the autocallable structured products, but as well have the interest rate at issuance and the issuers credit rating.

3. DATA AND METHODOLOGY

3.1. DATA

The data of the analysis is based upon 5-year historical prices for the period between 04/02/2015 and 03/02/2020 of the EuroStoxx 50 Index, collected from investing.com, which is the underlying of the product under consideration: the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

We consider as cost of funding, the Deutsche Bank's (the issuer) cost of funding for 2019, the year prior to the issuance of our product, which is calculated by dividing the value of Interest Expenses for 2019 and the Average interest-bearing liabilities for 2019, following Ayamanns et al (2016).

The risk-free rate is obtained through the 5-year Germany Government Bonds on 02/03/2020, that is the day prior to the issuance of our product.

In order to analyse the risk profile of investors who choose to invest in products such as the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, by consulting J.P. Morgan's 2023 Long-Term Capital Market Assumptions, there were selected some asset classes, as possible comparable investments. All these assets are part of J.P.'s Morgan's Euro assumptions for 2023.

Regarding the asset classes from J.P. Morgan's 2023 Long-Term Capital Market Assumptions, there were selected fixed income products, more specifically Euro

Aggregate Bonds, Euro Investment Grade Corporate Bonds, Euro High Yield Bonds, Euro Government Bonds, Euro Government Inflation-Linked Bonds.

Then, two alternative investments were chosen, European Core Real Estate and European Value-Added Real Estate.

To finalize the selection of alternative investments, Gold and assumptions of commodities in general, were chosen as well. In addition to these two, through Yahoo Finance, is obtained the historical data of Crude Oil, and through it, it is calculated the expected return and the 12-month annualized volatility.

3.2. METHODOLOGY

3.2.1. The product

The product that we are studying, the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, is a product that was issued by Deutsche Bank on the 4th of February 2020.

By analysing the KID (Key Information Document) of the product (it can be consulted in the appendices), it is possible to verify that this product provides return in the form of regular fixed coupon payments and a cash payment associated with the termination of the product, with the timing and amount of payments directly linked to the performance of the index.

The product was issued with an initial reference level of 3,732.28 index points as the strike level, the same index points of the adjusted close of the Euro Stoxx 50 Index on February 4, 2020, the same day the product was issued.

The product would automatically terminate if the index value matched or exceeded certain autocall barrier levels, on the autocall observation dates, the last of which is referred to as the valuation date, 3 days before maturity. For the first three autocall observation dates, in the 2nd of February of 2022, 1st of February of 2023 and the 1st of February of 2024, the autocall barrier level was 3,732.28 points, the same value as the initial reference level, with the autocall payment dates occurring, respectively, on the 7th of February of 2022, 6th of February of 2023 and the 6th of February 2024.

The last autocall observation date would occur on the 3rd of February of 2025, with the autocall payment date occurring on the maturity date, that is, the 6th of February of 2025, and in the latter case, the autocall barrier level assumes a value of 2,425.98 points, being exactly 65% of the initial reference level. Whenever applicable, the coupon payments would take place on February 8, 2021, February 7, 2022, February 6, 2023, February 6, 2024 and on the maturity date, that is, February 6, 2025.

It is important to notice that the product notional amount is 100€ and the coupon 2.65%. If the product ended on a certain date, the investor would receive 100€ of the notional amount and also the coupon for that period. Regarding to the termination on the maturity date, if the final reference level is above 2,432.982 points, the investor would receive the product notional amount as cash payment, but if the final reference level is below the previously mentioned barrier, the cash payment would be equal to the product notional amount multiplied by the final reference level divided by the strike level, like it is shown in the formula below:

$$Payoff \text{ at maturity} = \begin{cases} 100 \times \frac{Und_M}{K} & ; Und_M \leq B \\ 100 & ; Und_M > B \end{cases} \quad (1)$$

3.2.2. Pricing Model

Firstly, we calculate several historical volatilities, 3 Month Annualized Volatility, 6 Month Annualized Volatility, 1 Year Annualized Volatility, 2 Year Annualized Volatility, 3 Year Annualized Volatility, 4 Year Annualized Volatility and 5 Year Annualized Volatility.

The volatility analysis carried out followed the process of estimating volatility from historical data according to Hull (2022). By having the closing stock price (S_i) from a given day “ i ”, we compute the price relative, i.e., the variation from S_{i-1} :

$$S_i / S_{i-1}, \quad (2)$$

Then we have to compute the daily return:

$$u_i = \ln (S_i / S_{i-1}), \quad (3)$$

After the daily return, for the time period that we want to verify the daily volatilities, 3 months, 6 months, 1, 2, 3, 4 and 5 years, we have to aggregate the daily returns and compute the standard deviations.

After having the daily volatilities, we could compute the annualized volatilities for each period, by multiplying the daily volatilities by the square root of 252, the number of trading days per annum:

$$\text{Annualized Volatility} = \text{Daily Volatility} \times \sqrt{252} \quad (4)$$

In order to proceed with a valuation of the Fixed Coupon Express Certificate, we need to decompose it.

The product can be decomposed as a long position in an autocallable bond and a short position in a Down-and-In Put (DIP) option.

The autocallable bond pays a coupon, and it has a maturity of 5 years, with a payoff of 2.65% of the annual coupon and the product notional amount, when the product ends before 2025 or when it reaches the maturity above the barrier.

The DIP has a European Barrier and maturity of 5 years, with the payoff being the underlying performance or zero, having a strike of 100% and a barrier of 65%.

The autocallable bond may be further decomposed into a long coupon paying bond, with a 5-year maturity, and a long call option, bermudan type, with a 3-year maturity, between 2021, 2022, 2023 and 2024, with a strike of 100%.

As Hull (2022) affirms “Monte Carlo simulation is usually used for derivatives where the payoff is dependent on the history of the underlying variable or where there are several underlying variables.”, so we decided to proceed with the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index valuation through a Monte Carlo simulation.

In order to take into account the possibility of early termination at each year, we are simulating 10000 paths, using the Geometric Brownian Motion to perform them, each path with 30 time steps through 5 years. The drift term is the risk-free rate: -0.647%.

As Hull (2022) also states, the GBM is a stochastic process often assumed for asset prices where the logarithm of the underlying variable follows a generalized Wiener process.

$$S_1 = S_0 e^{\left(\mu - \frac{\sigma^2}{2}\right)\delta t + \sigma\varepsilon\sqrt{\delta t}} \quad (5)$$

We then perform a probability analysis in order to find out the probability of the product being called at each autocallable date.

This probability analysis is calculated by dividing the payoffs, greater than 2.65€ of a given year, obtained from the simulation and the total payoffs taken from the simulation of the same year. This method is used for the years 2022, 2023 and 2024. In 2025, as the maturity date occurs, the scenario needs to be split for the cases when the product ends below the barrier or above the barrier.

For cases where the product ends below the barrier, it is necessary to account for payoffs greater than zero and less than 102.65€ (product notional amount plus coupon payment) and divide by the total payoffs. When the product ends above the barrier, the probability is obtained by dividing the number of times the payoff is equal to 102.65€ and the total of registered payoffs obtained through the simulation.

A Cash-flow map is performed, for the chosen levels of volatility, in order to obtain the total payoff for each of the following scenarios:

- 1) Product terminates in 2022;
- 2) Product terminates in 2023,
- 3) Product terminates in 2024;
- 4.a) Product terminates in 2025 above the barrier;
- 4.b) Product terminates in 2025 below the barrier.

The total payoff is obtained by summing all the payoffs of each scenario, with payoffs being obtained through the bond, by the coupon and by the redemption of the nominal value, which is 100€, and through the put, if it occurs the scenario 4.b) Product terminates in 2025 below the barrier.

Firstly, we calculate the undiscounted payoffs of each year that the investor receives for each level of the underlying asset and then we separate the cash-flows from each year into 2 different categories: cash flows from the callable bond and the DIP option. With this approach we are able to achieve the expected payoff for each component of our structured product. We then discount the payoffs from each component, using the cost of funding rate, in order to calculate the final value of the product, achieved by adding the value of the short DIP option to the bond value (because the investor sells a DIP).

Subsequently, the intention is to calculate the expected lifespan of the product to understand how long the product would last, on average, for each of the three different volatilities levels: 7.01%, 12.78% and 29.25%. For that, the weighted average term to maturity is calculated using the probabilities of the product terminate in 2022, in 2023, in 2024 and 2025.

The following formula is the one used to compute the expected lifespan of the product.

$$EL = \sum_t^n t_i \times p_i \quad (6)$$

3.2.3. Risk Profile Analysis

Besides product valuation, this project also aims to get to know better the risk profile of the investors who choose to invest in products such as the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index. We start by considering various asset classes, as possible alternative investments, and compare investment choices through the investors' risk tolerance function (RTF).

The risk tolerance function (RTF) resulting from a second-order Taylor approximation is represented by the following formula:

$$f(\bar{R}, \sigma) = \bar{R} - \frac{1}{2} r_0 [\bar{R}^2 + \sigma^2] \quad (7)$$

Regarding the chosen assets, are represented the “Fixed Coupon Express Certificate linked to EURO STOXX 50 Index”, divided by different barrier levels, the EURO

STOXX 50 Index and the 5-year Government Bond, used as a reference for the risk-free rate in the product valuation.

The 5-year Government Bond, as it is assumed as a risk-free asset, has a volatility of 0% and -0.647% in expected return, the same value used as risk-free rate in the valuation of the structured product.

Regarding the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, we calculate the expected return and volatility taking into account different barriers. The original product has a barrier that represents 65% of the underlying value, and therefore, it is also calculated the product with the barriers representing 50%, 75%, 80% and 90% of the underlying value in order to verify some differences in investor preferences.

After obtaining the volatilities and expected returns of all assets, these values are replaced in the equation (3), simultaneously assigning fixed values for the degree of relative risk aversion. In terms of RRA coefficients (r_0), is considered a wide range from -2, -1 (risk lovers investors), to 0 (risk neutral investors) and various degrees of risk averse investors: 0.25, 0.5, 1, 1.25, 1.5, 2, 3, 4, 5 and 6. By substituting the RRA value and the expected return and volatility values, we obtain variations in each asset, along with the values of the degree of RRA. The results of this analysis will show which products the most risk-prone investors tend to invest in, and vice versa, establishing an effective comparison between the alternative financial instruments chosen and the main product of this project, the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

4. RESULTS – VALUATION

4.1. VOLATILITIES

The volatility analysis can be seen in Figure 1.

We chose the 12.78%, 1 Year Annualized Volatility from 3 of February of 2020, one day before the product was issued, as a reference volatility, and the 3-months annualized volatilities of 7.01% and 29.2%, (correspond to the lowest volatility, registered on the 29th of November of 2017 and the highest volatility registered on the 26th of October of 2015, respectively) as alternative volatility values.

These volatilities are computed through the 5 years of historical data of the Euro Stoxx 50.



Figure 1 – Annualized Volatility over Log Returns using Moving Standard Deviation.

4.2. PROBABILITY ANALYSIS

By carrying out a Monte Carlo simulation, it is possible to compute the probabilities related with different scenarios of termination of the product.

For each level of volatility, are calculated the probabilities of the product ending in 2022, 2023, 2024 and 2025 (at or above and below the barrier). Tables II, III and IV present the results.

Starting on Table I, from the reference volatility level (12.78%), the probability of the product ending in 2022 is 42.63%, in 2023 it is 9.47%, in 2024 it is 5.27%, in 2025 below the barrier is 10.10% and in 2025 at or above the barrier is 32.53%.

TABLE I
PROBABILITY ANALYSIS (VOLATILITY = 12.78%)

Possible Scenarios ($\sigma = 12.78\%$)	Product terminates in 2022	Product terminates in 2023	Product terminates in 2024	Product terminates in 2025 above the barrier	Product terminates in 2025 below the barrier
	42.63%	9.47%	5.27%	10.10%	32.53%

In Table II, for a volatility of 7.01%, the probability of the product ending in 2022 is 41.87%, in 2023 it is 9.29%, in 2024 it is 5.19%, in 2025 below the barrier is 0.65% and in 2025 at or above the barrier is 43.00%.

TABLE II
PROBABILITY ANALYSIS (VOLATILITY = 7.01%)

Possible Scenarios ($\sigma = 7.01\%$)	Product terminates in 2022	Product terminates in 2023	Product terminates in 2024	Product terminates in 2025 above the barrier	Product terminates in 2025 below the barrier
	41.87%	9.29%	5.19%	0.65%	43.00%

In Table III, for a 29.25% volatility, the probability of the product ending in 2022 is 39.86%, in 2023 it is 8.69%, in 2024 it is 4.91%, in 2025 below the barrier is 31.89% and in 2025 at or above the barrier is 14.65%.

TABLE III
PROBABILITY ANALYSIS (VOLATILITY = 29.25%)

Possible Scenarios ($\sigma = 29.25\%$)	Product terminates in 2022	Product terminates in 2023	Product terminates in 2024	Product terminates in 2025 above the barrier	Product terminates in 2025 below the barrier
	39.86%	8.69%	4.91%	31.89%	14.65%

4.3. CASH-FLOW MAP

Cash-flow maps reflect the calculations made relative to the payoffs that are obtained in each of the possible scenarios during the life of the product. These cash-flow maps can be verified in tables IV, V and VI.

Taking into account the benchmark volatility level of 12.78%, the total payoffs are:

- The Total Payoff for scenario 1 is 105.30€, resulting from the redemption of 100€, the notional amount, and the 2021 and 2022 coupons, 2.65€ each.
- The Total Payoff of scenario 2 is 107.95€, resulting from the redemption of 100€, the notional amount, and the 2021, 2022 and 2023 coupons, €2.65 each.
- The Total Payoff of scenario 3 is 110.60€, resulting from the redemption of 100€, the notional amount, and the 2021, 2022, 2023 and 2024 coupons 2.65€ each.
- The Total Payoff of scenario 4 is 113.25€, resulting from the redemption of 100€, the notional amount, and the 2021, 2022, 2023, 2024 and 2025 coupons, 2.65€ each.
- The Total Payoff of scenario 5 is 69.92€, resulting from the redemption of 100€, the notional amount, and the 2021, 2022, 2023, 2024 and 2025 coupons, 2.65€ each.

TABLE IV
CF MAP (VOLATILITY = 12.78%)

Possible Scenarios:	Probability	Cash-Flow	Cash-Flow in	Cash-Flow in	Cash-Flow	Cash-Flow in 2025		Total payoff
		in 2021	2022	2023	in 2024	From the Bond	From the DIP	
1. Product terminates in 2022	42.63%	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	0.00 €	105.30 €
2. Product terminates in 2023	9.47%	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	107.95 €
3. Product terminates in 2024	5.27%	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	110.60 €
4. Product terminates in 2025 above the barrier	32.53%	2.65 €	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	113.25 €
5. Product terminates in 2025 below the barrier	10.10%	2.65 €	2.65 €	2.65 €	2.65 €	2.65 €	56.67€	69.92€

TABLE V
CF MAP (VOLATILITY = 7.01%)

Possible Scenarios:	Probability	Cash-Flow	Cash-Flow in	Cash-Flow in	Cash-Flow	Cash-Flow in 2025		Total payoff
		in 2021	2022	2023	in 2024	From the Bond	From the DIP	
1. Product terminates in 2022	41.87%	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	0.00 €	105.30 €
2. Product terminates in 2023	9.29%	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	107.95 €
3. Product terminates in 2024	5.19%	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	110.60 €
4. Product terminates in 2025 above the barrier	43.00%	2.65 €	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	113.25 €
5. Product terminates in 2025 below the barrier	0.65%	2.65 €	2.65 €	2.65 €	2.65 €	2.65 €	62.11€	75.36€

TABLE VI
CF MAP (VOLATILITY = 29.25%)

Possible Scenarios:	Probability	Cash-Flow	Cash-Flow in	Cash-Flow in	Cash-Flow	Cash-Flow in 2025		Total payoff
		in 2021	2022	2023	in 2024	From the Bond	From the DIP	
1. Product terminates in 2022	39.86%	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	0.00 €	105.30 €
2. Product terminates in 2023	8.69%	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	0.00 €	107.95 €
3. Product terminates in 2024	4.91%	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	0.00 €	110.60 €
4. Product terminates in 2025 above the barrier	14.65%	2.65 €	2.65 €	2.65 €	2.65 €	102.65 €	0.00 €	113.25 €
5. Product terminates in 2025 below the barrier	31.89%	2.65 €	2.65 €	2.65 €	2.65 €	2.65 €	41.49€	54.74€

For the other volatility levels, the major difference are the changes in the payoff from the DIP in the year 2025, in case the product ends below the barrier. As the volatility increases, the payoff from the DIP gets lower.

4.4. CONDITIONAL PROBABILITIES

We carried out an analysis regarding conditional probabilities, to understand the probability of the product ending in a given year, taking into account the condition of having survived the previous year.

Tables VII, VIII and IX present the conditional probabilities:

TABLE VII
CONDITIONAL PROBABILITIES (VOLATILITY = 12.78%)

Condition	Prob. of terminating in 2022	Prob. of terminating in 2023	Prob. of terminating in 2024	Prob. of terminating in 2025	Sum of all probabilities	Prob. of terminating in 2025	
						Above the barrier	Below the barrier
Unconditional	42.63%	9.47%	5.27%	42.63%	100.00%	32.53%	10.10%
Product Survives 2022		16.51%	9.19%	74.31%	100.00%	56.70%	17.61%
Product Survives 2023			11.00%	89.00%	100.00%	67.91%	21.09%
Product Survives 2024				100.00%	100.00%	76.31%	23.69%

When the volatility is equal to 7.01%, the following probabilities are obtained:

TABLE VIII
CONDITIONAL PROBABILITIES (VOLATILITY = 7.01%)

Condition	Prob. of terminating in 2022	Prob. of terminating in 2023	Prob. of terminating in 2024	Prob. of terminating in 2025	Sum of all probabilities	Prob. of terminating in 2025	
						Above the barrier	Below the barrier
Unconditional	41.87%	9.29%	5.19%	43.65%	100.00%	43.00%	0.65%
Product Survives 2022		15.98%	8.93%	75.09%	100.00%	73.97%	1.12%
Product Survives 2023			10.63%	89.37%	100.00%	88.04%	1.33%
Product Survives 2024				100.00%	100.00%	98.51%	1.49%

With volatility equal to 29.25%, it is possible to verify the probabilities obtained in the following table:

TABLE IX
 CONDITIONAL PROBABILITIES (VOLATILITY = 29.25%)

Condition	Prob. of terminating in 2022	Prob. of terminating in 2023	Prob. of terminating in 2024	Prob. of terminating in 2025	Sum of all probabilities	Prob. of terminating in 2025	
						Above the barrier	Below the barrier
Unconditional	39.86%	8.69%	4.91%	46.54%	100.00%	14.65%	31.89%
Product Survives 2022		14.45%	8.16%	77.39%	100.00%	24.36%	53.03%
Product Survives 2023			9.54%	90.46%	100.00%	28.47%	61.98%
Product Survives 2024				100.00%	100.00%	31.48%	68.52%

It is possible to verify that as the volatility decreases, it is much more likely that the product ends at or above the barrier than below the barrier, and in the case of volatility being equal to 29.25%, in all scenarios, when the product ends in 2025, there is a greater probability that it will end below the barrier than at or above the barrier, and the probability of the product ending below the barrier always grows, from year to year, more than the probability of ending at or above the barrier.

4.5. PAYOFF DISTRIBUTION IN 2025

We analyzed the distribution of all payoffs for the cases where the product survives year 4, that is, the year 2024, and ends in 2025 below the barrier. For the reference volatility, 12.78%, Figure 2 shows that it is possible to verify that when the product survives the 4th year, most of the payoffs of the year 2025, when the product ends, are above 100€, with more than 3000 occurrences out of a total of 10000, considering that, when the product ends up below the barrier, in which case the notional amount is not paid, there is an increasing tendency for occurrences as the payoff increases. Thus, when the product ends in 2025 below the barrier (Figure 3), there is a greater number of occurrences from 60€ onwards.

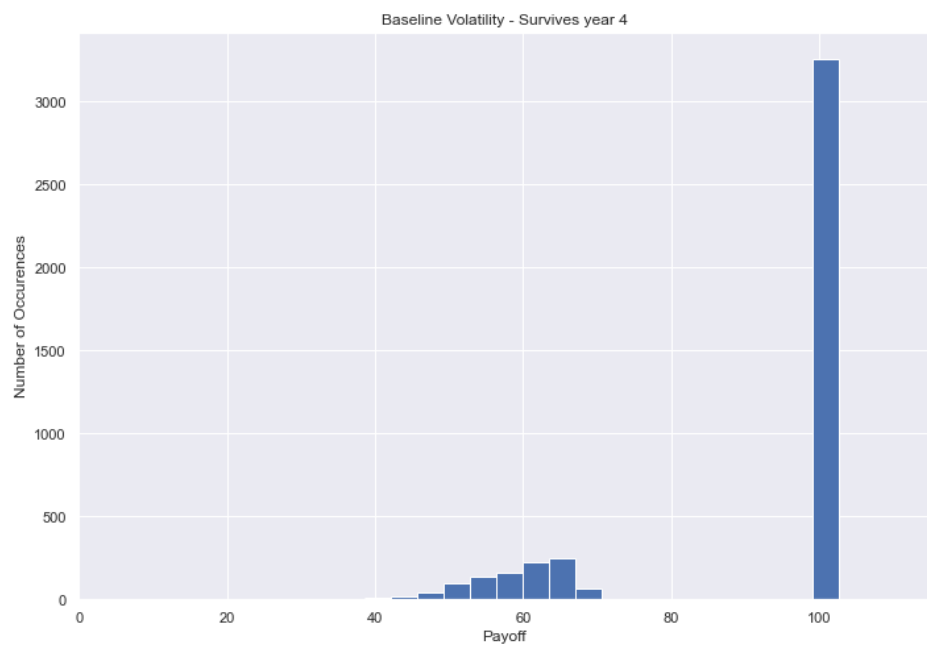


Figure 2 - Payoff distribution in 2025 ($\sigma = 12.78\%$) if the product terminates in 2025.

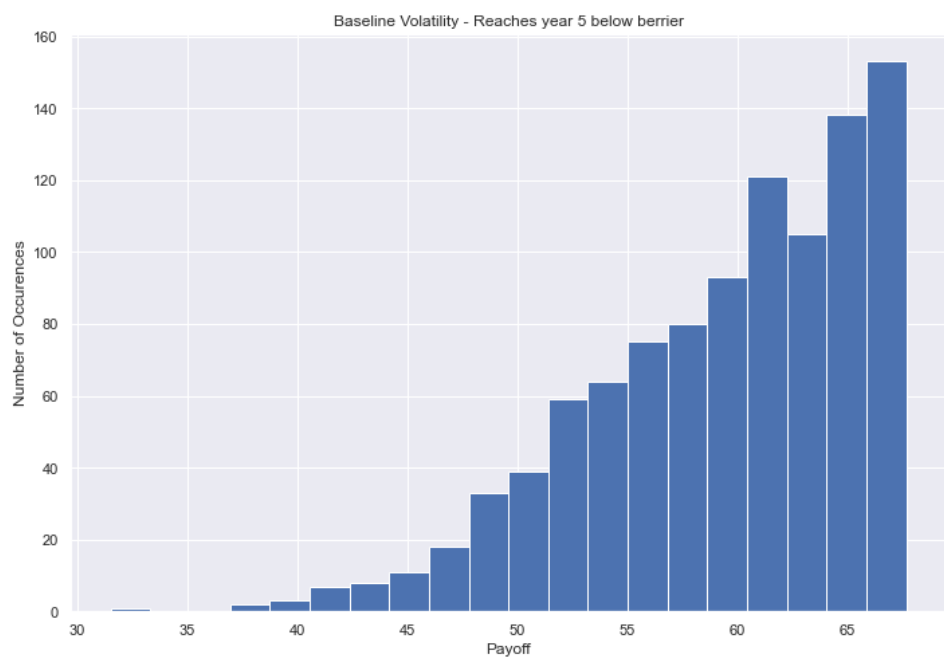


Figure 3 - Payoff distribution in 2025 ($\sigma = 12.78\%$) if the product terminates in 2025 below the barrier.

When the volatility is equal to 7.01% (Figure 4), most of the occurrences, more than 4000 out of 10000, are greater than 100€, more occurrences than in the volatility of 12.78%. When the product ends in 2025 below the barrier (Figure 5), there is again a growth trend, with most occurrences being represented between 66€ and 68€.

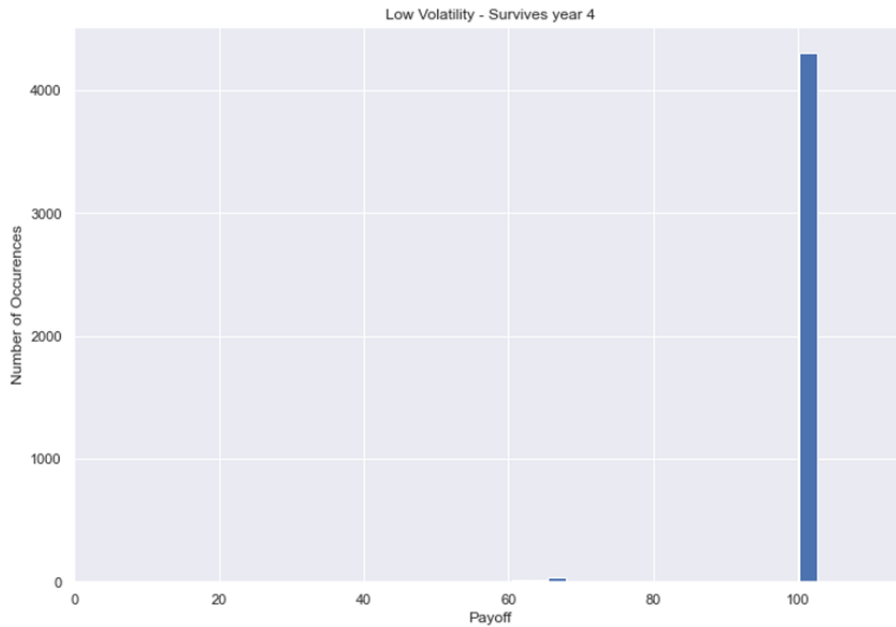


Figure 4 - Payoff distribution in 2025 ($\sigma = 7.01\%$) if the product terminates in 2025.

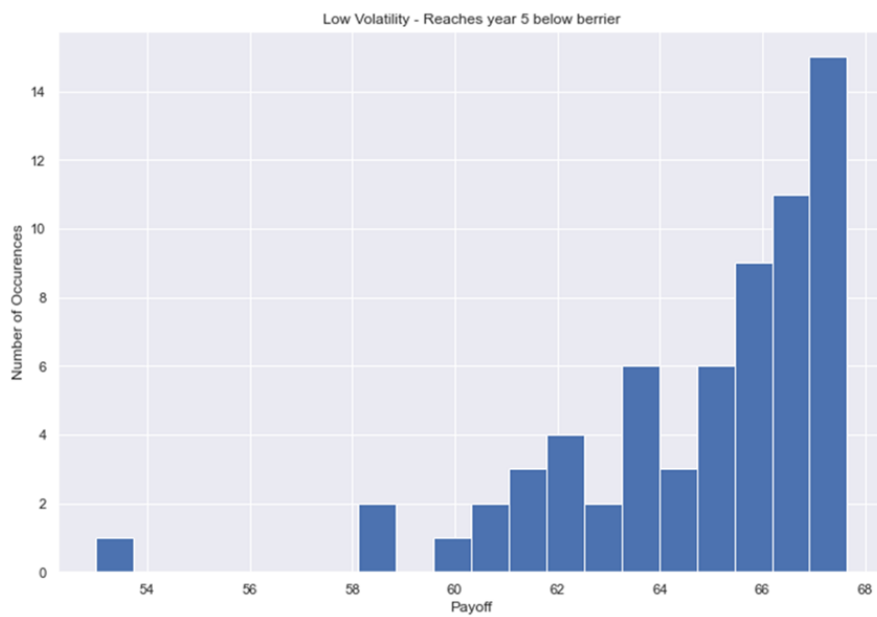


Figure 5 - Payoff distribution in 2025 ($\sigma = 7.01\%$) if the product terminates in 2025 below the barrier.

With volatility equal to 29.25% (Figure 6), when the product survives the 4th year, the predominance of occurrences continues to be above 100€, but in this case just over 1400 occurrences out of a total of 10000, with a constant distribution of occurrences between 20€ and 60€. When the product ends in 2025 below the barrier (Figure 7), there is a growth trend from 10€ to close to 40€, then there is some consistency up to around 60€, where occurrences begin to decrease.

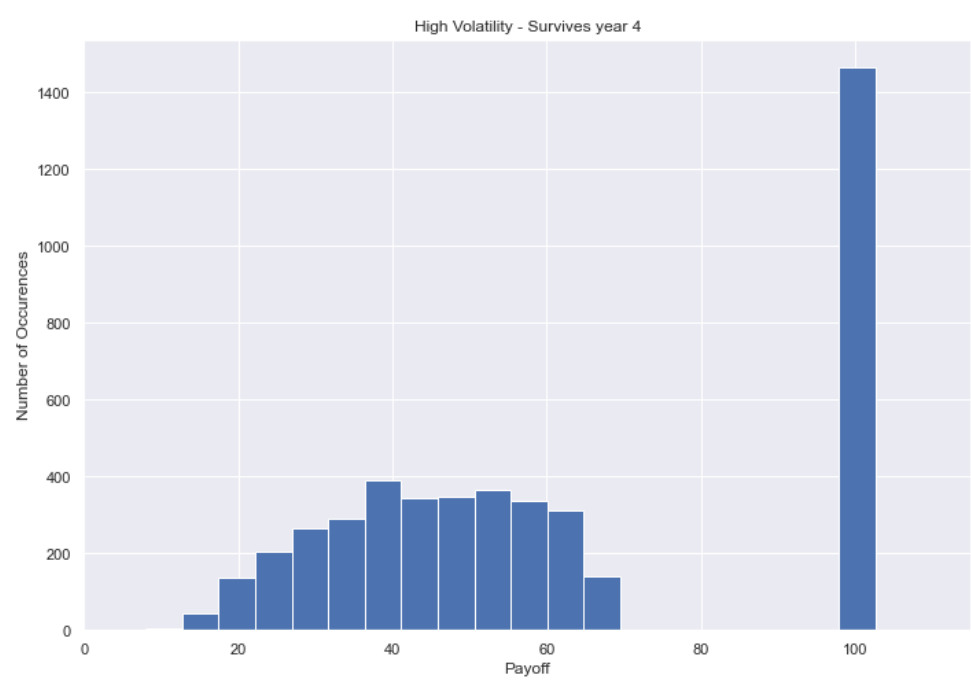


Figure 6 - Payoff distribution in 2025 ($\sigma = 29.25\%$) if the product terminates in 2025.

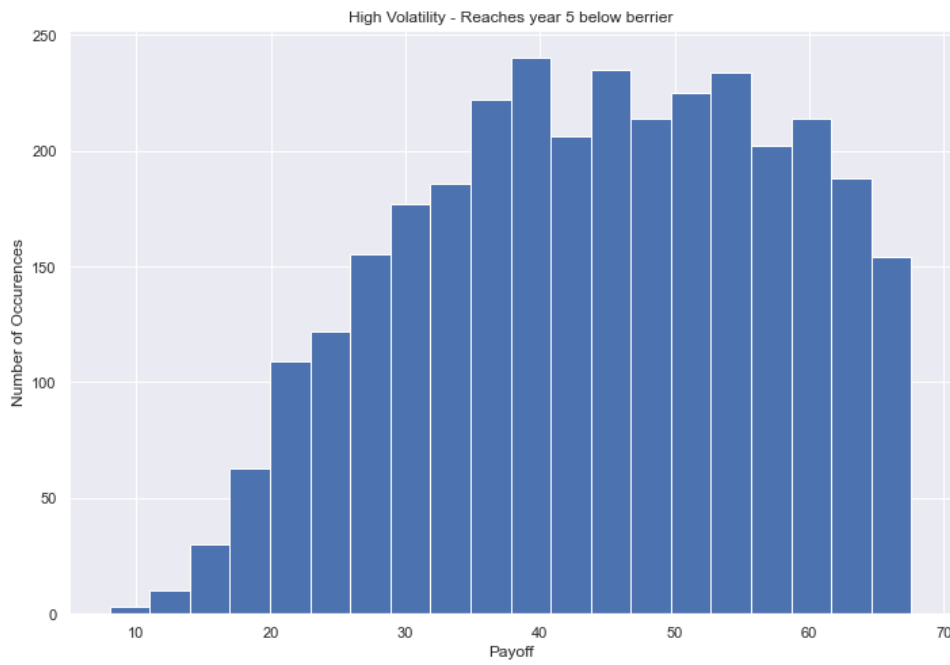


Figure 7 - Payoff distribution in 2025 ($\sigma = 29.25\%$) if the product terminates in 2025 below the barrier.

4.6. VALUATION

A simulation of values is performed and by taking them into account, the payoffs are calculated for each of the 5 years. Then, the payoffs of each year are discounted using the funding rate, and an average of all the total discounted payoffs is calculated, in order to have the value of the discounted callable bond. Next, the discounted expected value of the DIP is calculated, which only occurs in the year 2025.

Table X presents values for each product's component for the three volatilities used.

For a volatility of 12.78%, the value of the callable bond is equal to 94.17€ and the value of the DIP is equal to 5.29€, thus making a total value of the product of 99.46€.

For a volatility of 29.25%, the value of the callable bond is equal to 74.15€ and the value of the DIP is equal to 12.22€, thus making a total value of the product of 86.37€.

For a volatility of 7.01%, the value of the callable bond is equal to 102.93€ and the value of the DIP is equal to 0.37€, thus making a total value of the product of 103.30€.

TABLE X
PRODUCT VALUATION

Components	$\sigma = 7.01\%$	$\sigma = 12.78\%$	$\sigma = 29.25\%$
Callable Bond	102.93€	94.17€	74.15€
Down-and-In Put	0.37€	5.29€	12.22€
Product Value	103.30€	99.46€	86.37€

It is therefore possible to conclude that as the volatility of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index increases, the value of the DIP increases, because, as the volatility gets higher, the probability of the product to end below the barrier increases. The value of the callable bond decreases, and once this decrease is higher, in terms of absolute values, than the increase of the DIP, the value of the product decreases.

4.7. LIFESPAN OF THE PRODUCT

Table XI presents the average lifespan of the product, also known as fugit.

In order to calculate the lifespan of the product, for each year of product duration, the multiplication between the number of years and the probability of the product ending in this same year is obtained, summing all the values at the end. Therefore, taking into account the probability of the product ending in 2022, it is multiplied by 2, the number of years that the product would have survived, considering that for the case of the product ending in 2023 and in 2024, the values of the probabilities of ending in the respective years would be multiplied by 3 and by 4. In the year 2025, were added the probabilities of the product ending up below and at or above the barrier and then multiplied by 5.

TABLE XI
EXPECTED LIFESPAN OF THE PRODUCT

Volatility	Probability of terminating in 2022	Probability of terminating in 2023	Probability of terminating in 2024	Probability of terminating in 2025	Duration
7.01%	0.4187	0.0929	0.0519	0.4365	3.5062 years
12.78%	0.4263	0.0947	0.0527	0.4263	3.479 years
29.25%	0.3986	0.0869	0.0491	0.4654	3.5813 years

5. RESULTS – RISK PROFILE ANALYSIS

The expected return and the volatility of each of the chosen assets is calculated. Following this calculation, these two values obtained are replaced in the Risk Tolerance Function, alongside with the variation of the RRA degrees.

The first combination of results is intended to compare the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the original barrier, that is, 2,425.98 points which represent 65% of 3,732.28 points with:

- i) the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the barrier of 90%, equal to 3,359.05 points
- ii) the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the barrier of 80%, equal to 2,985.82 points
- iii) the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the barrier of 75%, equal to 2,799.21 points
- iv) the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the barrier of 50%, equal to 1,866.14 points

Table XII presents the volatility and expected return for each case.

TABLE XII

THE FIXED COUPON EXPRESS CERTIFICATE LINKED TO EURO STOXX 50 INDEX
WITH DIFFERENT BARRIER LEVELS

Products	Volatility	Expected Return
Structured Product (Original Barrier – 65%)	12.20%	4.84%
Structured Product (90%)	23.25%	-7.07%
Structured Product (80%)	22.53%	-4.04%
Structured Product (75%)	21.38%	-1.81%
Structured Product (50%)	9.81%	8.05%

From Figure 8, we can verify that the risk lovers, risk neutral and risk averse investors have the same order of preferences. The Fixed Coupon Express Certificate linked to EURO STOXX 50 Index with the barrier level of 50% of the strike level is the favourite, followed by the one with the 65% barrier level, and so on, in an increasing order, until the product with the 90% barrier level.

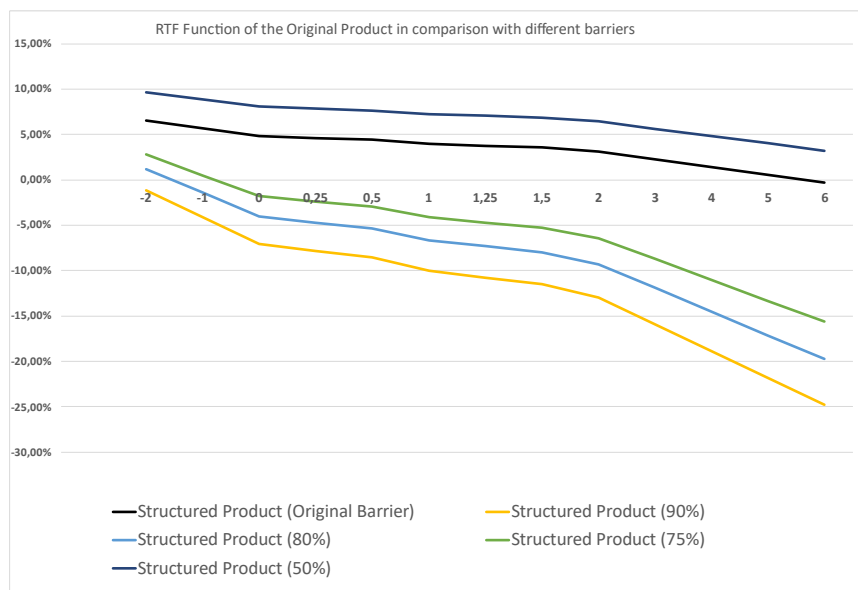


Figure 8 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with the same product but with different barriers.

Regarding to the comparison between the RTF of the Fixed Coupon Express Certificate linked to the EURO STOXX 50 Index and the RTF of the EURO STOXX 50 Index (Figure 9), it is possible to verify that all the different types of investors prefer to invest in the EURO STOXX 50 Index. This happens because for almost the same level of volatility, the Euro STOXX 50 Index has almost the double of the expected return of the product that we are studying.

TABLE XIII
EURO STOXX 50 INDEX

Products	Volatility	Expected Return
EURO STOXX 50 Index	12.96%	9.27%

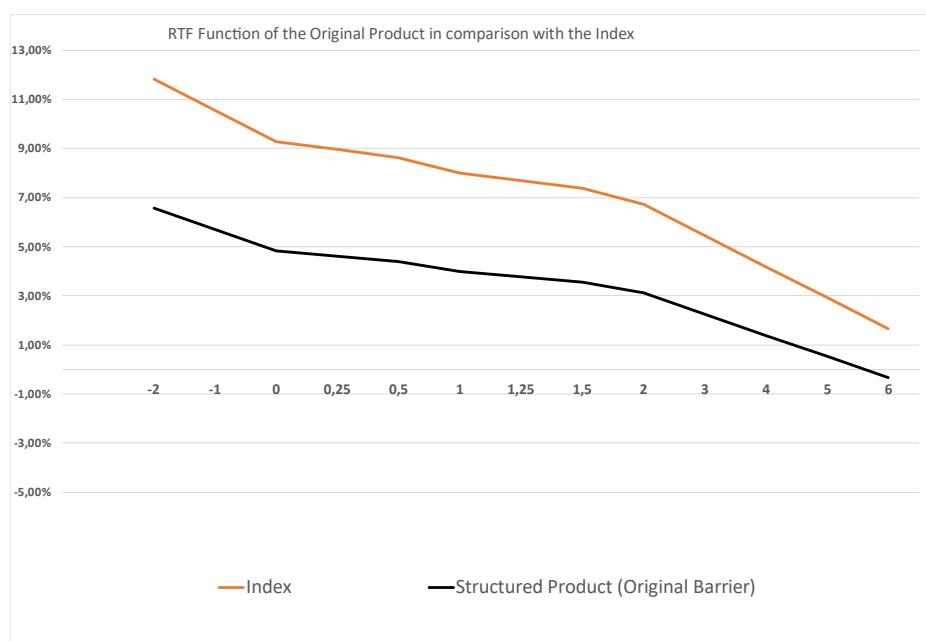


Figure 9 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with the EURO STOXX 50 Index.

Now, a comparison is made between the RTF of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index and the RTF of the chosen classes of bonds.

TABLE XIV
GOVERNMENT AND CORPORATE BONDS

Products	Volatility	Expected Return
Government Bond	0.00%	-0.65%
Euro Aggregate Bonds	4.48%	3.00%
Euro Investment Grade Corporate Bonds	5.10%	3.60%
Euro High Yield Bonds	9.70%	5.70%
Euro Government Bonds	4.88%	2.80%
Euro Government Inflation-Linked Bonds	3.70%	2.60%

It can be verified, from Figure 10, that Euro High Yield Bonds is dominating investors' preferences slightly until degree 5 of RRA, where they are overtaken by Euro Investment Grade Corporate Bonds. The Fixed Coupon Express Certificate linked to EURO STOXX 50 Index is in the second position of preferences until shortly after degree 1.5 of RRA. Before degree 3, the product studied is already the penultimate instrument in the order of preferences, with a tendency to pass to be the least preferred from degree 6 onwards.

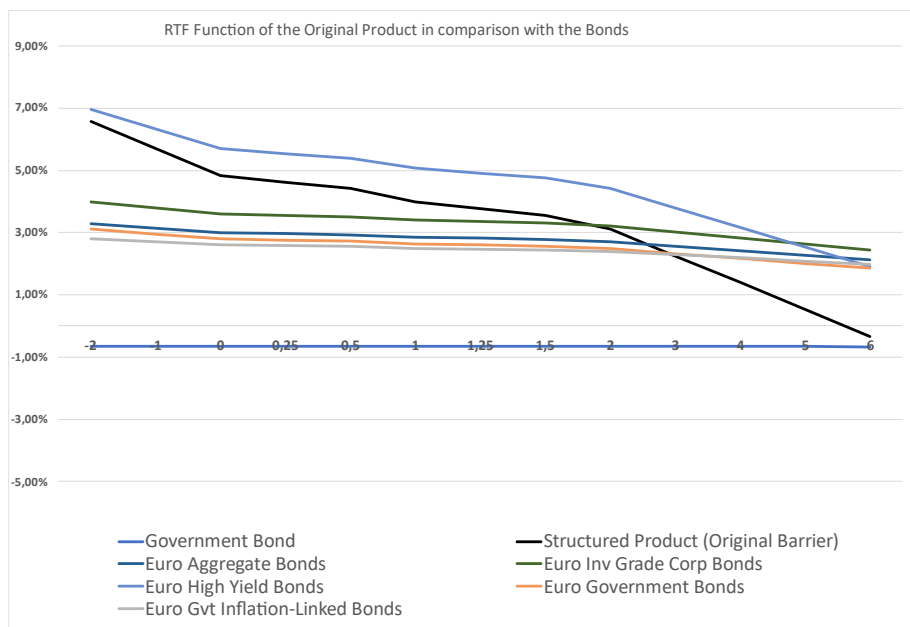


Figure 10 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different classes of bonds.

Alternative financial instruments were also chosen, in this case linked to Real Estate, the European Core Real Estate and the European Value-Added Real Estate, and based on the assumptions obtained, the RTF of each one of them is calculated:

TABLE XV

REAL ESTATE FINANCIAL INSTRUMENTS

Products	Volatility	Expected Return
European Core Real Estate	10.15%	4.70%
European Value-Added Real Estate	16.75%	6.70%

In this case, (see Figure 11) it is possible to verify that the European Value-Added Real Estate picks up the preferences of risk lovers, risk neutral and risk averse until around degree 2, where it quickly becomes the least preferred of the 3 products in comparison.

Regarding the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index, it is preferred by risk lovers and risk neutral compared to the European Core Real Estate. From the degree of 0.5, the risk averse start to prefer the European Core Real Estate to the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

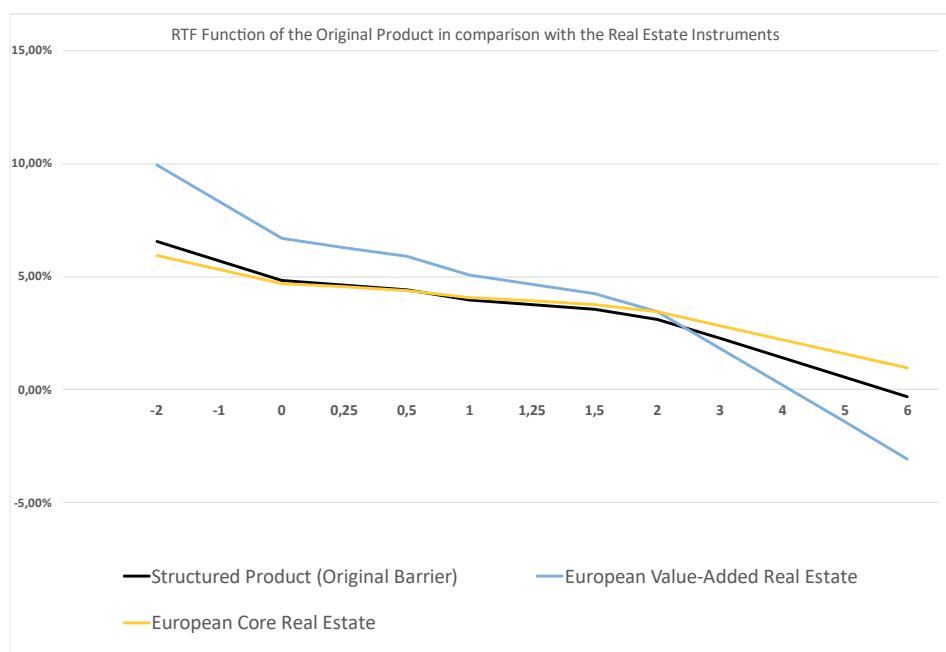


Figure 11 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different Real Estate financial instruments.

Finally, the following analysis compares the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index RTF with Crude Oil, Gold and commodity assumptions in general.

TABLE XVI

COMMODITIES

Products	Volatility	Expected Return
Crude Oil	33.91%	5.44%
Gold	16.15%	1.40%
Commodities	16.36%	1.00%

According to Figure 12, it is possible to verify that Crude Oil is the preferred investment for risk lovers and for risk neutral, becoming the second favourite after degree 0, until degree 1, where it quickly becomes the least preferred investment for almost all risk averse investors.

The Fixed Coupon Express Certificate linked to EURO STOXX 50 Index is the second preferred investment by risk lovers and risk neutral and is the preferred by risk averse.

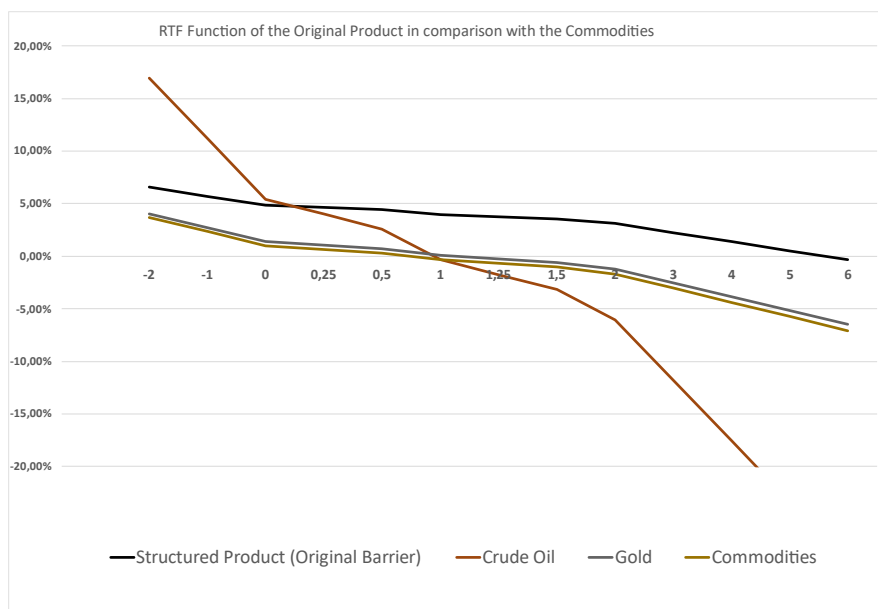


Figure 12 – Risk Tolerance Function of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index in comparison with different classes of commodities.

6. CONCLUSION

It is possible to verify that, within the average volatility levels of the analysis that we carried out, the value of the product is close to the value of the product notional amount. The lower the volatility, the greater the value of the product, with a greater risk of the investor paying more for the product than what it is worth when volatility increases.

There is a high probability that the product may end on the first autocall date, with a greater risk of not receiving the product notional amount, when the product ends below the barrier in 2025, as the volatility level increases.

Although there is a high probability that the product may end on the first autocall date, the life expectancy of the product is slightly constant between the different levels of volatility, pointing to a duration of three and a half years, relatively to a maximum period of five years.

Regarding to investor preferences, concerning the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index compared to other financial instruments, it is possible to conclude that risk lovers investors tend to prefer the product that we are studying over a considerable number of the other chosen investment vehicles, a preference that tends to decrease as the relative risk averse degrees increase. Risk lovers in general express a greater preference for the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index than risk neutral and risk averse investors.

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8. APPENDICES



Key Information Document

Purpose

This document provides you with key information about this investment product. It is not marketing material. The information is required by law to help you understand the nature, risks, costs, potential gains and losses of this product and to help you compare it with other products.

Product

Product name	Fixed Coupon Express Certificate linked to EURO STOXX 50® Index (Price Index)
Product identifiers	ISIN: DE000DB9U0V9 WKN: DB9U0V
PRIIP manufacturer	Deutsche Bank AG. The product issuer is Deutsche Bank AG, Frankfurt.
Website	www.db.com/contact
Telephone number	Call +49-69-910-00 for more information.
Competent authority of the PRIIP manufacturer	German Federal Financial Supervisory Authority (BaFin)
Date of production	7 December 2021

You are about to purchase a product that is not simple and may be difficult to understand.

1. What is this product?

Type German law governed certificates

Objectives

The product is designed to provide a return in the form of (1) regular fixed coupon payments and (2) a cash payment on termination of the product. The timing and amount of this payment will depend on the performance of the **underlying**.
Early termination following an autocal: The product will terminate prior to the **maturity date** if, on any **autocal observation date**, the **reference level** is at or above the relevant **autocal barrier level**. On any such early termination, you will on the immediately following **autocal payment date** receive, in addition to a final coupon payment, a cash payment equal to the autocal payment of EUR 100. No coupon payments will be made on any date after such **autocal payment date**. The relevant dates and **autocal barrier levels** are shown in the table(s) below.

Autocal observation dates	Autocal barrier levels	Autocal payment dates
2 February 2022	3,732.28	7 February 2022
1 February 2023	3,732.28	6 February 2023
1 February 2024	3,732.28	6 February 2024
3 February 2025	2,425.982	Maturity date

Coupon: If the product has not terminated early, on each **coupon payment date** you will receive a coupon payment of EUR 2.65. The coupon payments are not linked to the performance of the **underlying**. The relevant dates are shown in the table(s) below.

Coupon payment dates
8 February 2021
7 February 2022
6 February 2023
6 February 2024
Maturity date

Termination on the maturity date: If the product has not terminated early, on the **maturity date** you will receive:

- If the **final reference level** is at or above the **barrier level**, a cash payment equal to EUR 100; or
- If the **final reference level** is below the **barrier level**, a cash payment directly linked to the performance of the **underlying**. The cash payment will equal (i) the **product notional amount** multiplied by (ii) (A) the **final reference level** divided by (B) the **strike level**.

Under the product terms, certain dates specified above and below will be adjusted if the respective date is either not a business day or not a trading day (as applicable). Any adjustments may affect the return, if any, you receive.

When purchasing this product during its lifetime, the purchase price may include accrued coupon on a pro rata basis.

You do not have any entitlement to a dividend from the **underlying** and you have no right to any further entitlement resulting from the **underlying** (e.g., voting rights).

Underlying	EURO STOXX 50 (Price return index) (ISIN: EU0009658145)	Strike level	3,732.28
Underlying market	Equity	Barrier level	2,425.982
Product notional amount	EUR 100	Reference level	The closing level of the underlying as per the reference source
Product currency	Euro (EUR)	Reference source	STOXX Limited, Zurich
Underlying currency	Euro (EUR)	Final reference level	The reference level on the valuation date
Issue date	4 February 2020	Valuation date	3 February 2025
Initial reference level	3,732.28	Maturity date / term	6 February 2025

The issuer may terminate the product with immediate effect in the event of obvious written or mathematical errors in the terms and conditions or if certain extraordinary events provided in the terms and conditions occur. Examples of extraordinary events include (1) material changes, particularly in connection with the **underlying**, including where an index ceases to be calculated, and (2) events, in

Figure 13 – Page 1 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

particular due to changes in certain external conditions that hinder the issuer in meeting its obligations in connection with the product or – depending on the terms and conditions of the security – otherwise affect the product and/or the issuer. In case of immediate termination, the return (if any) may be significantly lower than the purchase price, but will reflect the product's market value and, if higher, any minimum redemption (alternatively, in some cases the corresponding compounded amount may be paid out at the product's scheduled maturity). Instead of immediate termination, the issuer may also amend the terms and conditions.

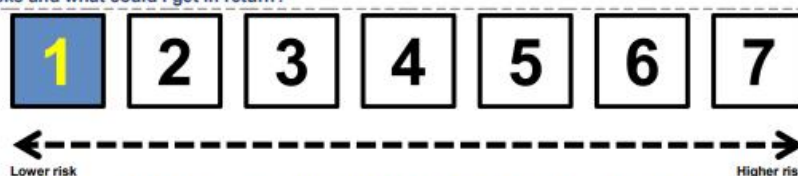
Provided that in the event of any inconsistency and/or conflict between the foregoing paragraph and any applicable law, order, rule or other legal requirement of any governmental or regulatory authority in a territory in which this product is offered, such national requirements shall prevail.

Intended retail investor

The product is intended for private clients who pursue the objective of general capital formation/asset optimization and have a medium-term investment horizon. This product is a product for clients who have sufficient knowledge and / or experience to make an informed investment decision. The investor can bear losses up to the total loss of the capital invested and attaches no importance to capital protection.

2. What are the risks and what could I get in return?

Risk indicator



Lower risk

Higher risk



The risk indicator assumes you keep the product for 3 years and 2 months. The actual risk can vary significantly if you cash in at an early stage and you may get back less.

The summary risk indicator is a guide to the level of risk of this product compared to other products. It shows how likely it is that the product will lose money because of movements in the markets or because we are not able to pay you.

We have classified this product as 1 out of 7, which is the lowest risk class. This rates the potential losses from future performance at a very low level, and poor market conditions are very unlikely to impact our capacity to pay you.

This product does not include any protection from future market performance so you could lose some or all of your investment.

If we are not able to pay you what is owed, you could lose your entire investment.

Performance scenarios

Market developments in the future cannot be accurately predicted. The scenarios shown are only an indication of some of the possible outcomes based on recent returns. Actual returns could be lower.

Investment: EUR 10,000

Scenarios		1 year	2 years	3 years and 2 months (Recommended holding period)
Stress scenario	What you might get back after costs	EUR 8,339.17	EUR 9,056.79	EUR 10,161.35
	Average return each year	-16.61%	-4.82%	0.51%
Unfavourable scenario	What you might get back after costs	EUR 9,977.56	EUR 9,962.67	EUR 10,161.35
	Average return each year	-0.22%	-0.19%	0.51%
Moderate scenario	What you might get back after costs	EUR 10,171.53	EUR 10,182.25	EUR 10,161.35
	Average return each year	1.72%	0.91%	0.51%
Favourable scenario	What you might get back after costs	EUR 10,174.80	EUR 10,208.30	EUR 10,161.35
	Average return each year	1.75%	1.04%	0.51%

This table shows the money you could get back over the next 3 years and 2 months under different scenarios, assuming that you invest EUR 10,000.

The scenarios shown illustrate how your investment could perform. You can compare them with the scenarios of other products. The scenarios presented are an estimate of future performance based on evidence from the past on how the value of this investment varies, and are not an exact indicator. What you get will vary depending on how the market performs and how long you keep the product. The stress scenario shows what you might get back in extreme market circumstances, and it does not take into account the situation where we are not able to pay you.

The figures shown include all the costs of the product itself, but may not include all the costs that you pay to your advisor or distributor. The figures do not take into account your personal tax situation, which may also affect how much you get back.

3. What happens if Deutsche Bank AG, Frankfurt is unable to pay out?

You are exposed to the risk that the issuer might be unable to fulfil its obligations in respect of the product – e.g. in the event of insolvency (inability to pay / over-indebtedness) or an administrative order of resolution measures. In case of a crisis of the issuer such an order can also be issued by a resolution authority in the run-up of an insolvency proceeding. In doing so, the resolution authority has extensive intervention powers. Among other things, it can reduce rights of the investors to zero, terminate the product or convert it into shares of the issuer and suspend rights of the investors. With regard to the basic ranking of the issuer's obligations in the event of action by the resolution authority, please see www.bafin.de and search for the keyword "Haftungskaskade". A total loss of your capital invested is possible. The product is a debt instrument and as such is not covered by any deposit protection scheme.

4. What are the costs?

The Reduction in Yield (RIY) shows what impact the total costs you pay will have on the investment return you might get. The total costs take into account one-off, ongoing and incidental costs.

Figure 14 – Page 2 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.

The amounts shown here are the cumulative costs of the product itself, for three different holding periods. They include potential early exit penalties. The figures assume you invest EUR 10,000. The figures are estimates and may change in the future.

Costs over time

Investment: EUR 10,000			
Scenarios	If you cash in after 1 year	If you cash in after 2 years	If you cash in at the end of the recommended holding period
Total costs	EUR 0.00	EUR 0.00	EUR 0.00
Impact on return (RIY) per year	0.00%	0.00%	0.00%

The costs shown in the table above represent how much the expected costs of the product would affect your return, assuming the product performs in line with the moderate performance scenario.

The person selling you or advising you about this product may charge you other costs. If so, this person will provide you with information about these costs, and show you the impact that all costs will have on your investment over time.

Composition of costs

The table below shows:

- The impact each year of the different types of costs on the investment return you might get at the end of the recommended holding period.
- The meaning of the different cost categories.

The table shows the impact on return per year.

The table shows the impact on return per year.			
One-off costs	<i>Entry costs</i>	0.00%	The impact of the costs already included in the price.
	<i>Exit costs</i>	0.00%	The impact of the costs of exiting your investment when it matures.
Ongoing costs	<i>Portfolio transaction costs per year</i>	0.00%	The impact of the costs of us buying and selling underlying investments for the product.
	<i>Other ongoing costs</i>	0.00%	The impact of the costs that we take each year for managing your investments.

5. How long should I hold it and can I take money out early?

Recommended holding period: 3 years and 2 months

The product aims to provide you with the return described under "1. What is this product?" above. However, this only applies if the product is held to maturity. It is therefore recommended that the product is held until 6 February 2025 (maturity).

The product does not guarantee the possibility to disinvest other than by selling the product either (1) through the exchange (where the product is listed) or (2) off-exchange. No fees or penalties will be charged by the issuer for any such transaction. However if you sell the product in the secondary market you will incur a bid/offer spread. By selling the product before its maturity, you may receive back less than you would have received if you had kept the product until maturity.

Exchange listing	Börse Stuttgart and Deutsche Börse AG	Last exchange trading day	31 January 2025 (Börse Stuttgart) and 31 January 2025 (Deutsche Börse AG)
Smallest tradable unit	1 unit	Price quotation	Units

In volatile or unusual market conditions, or in the event of technical faults/disruptions, the purchase and/or sale of the product can be temporarily hindered and/or suspended and may not be possible at all.

6. How can I complain?

Any complaint regarding the conduct of the person advising on, or selling, the product can be submitted directly to that person.

Any complaint regarding the product or the conduct of the manufacturer of this product can be submitted in writing at:

Jurisdiction	Postal address	Email address	Website
Germany	Deutsche Bank AG, X-markets, Mainzer x-markets.team@db.com Landstrasse 11-17, 60329 Frankfurt am Main, Germany	www.xmarkets.db.com	
Austria	Deutsche Bank AG, X-markets, Mainzer x-markets.team@db.com Landstrasse 11-17, 60329 Frankfurt am Main, Germany	www.xmarkets.db.com	
Luxembourg	Deutsche Bank AG, X-markets, Mainzer x-markets.team@db.com Landstrasse 11-17, 60329 Frankfurt am Main, Germany	www.xmarkets.db.com	

7. Other relevant information

Any additional documentation in relation to the product and in particular the prospectus, any supplements thereto and the final terms are published on the manufacturer's website (www.xmarkets.db.com/DocumentSearch, after entering of the respective ISIN or WKN), all in accordance with legal requirements. In order to obtain more detailed information - and in particular details of the structure and risks associated with an investment in the product - you should read these documents. These documents are also available free of charge from Deutsche Bank AG, Mainzer Landstrasse 11-17, 60329 Frankfurt am Main, Germany, in accordance with legal requirements.

Figure 15 - Page 3 of the KID of the Fixed Coupon Express Certificate linked to EURO STOXX 50 Index.