

STUDY ON

DISCOUNT CERTIFICATES

2022

conducted by TTMzero and the Boerse Stuttgart Group on behalf
of the German Derivatives Association (DDV)

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1 INTRODUCTION

As one of the first categories of structured products on the market, discount certificates have maintained their popularity for more than 25 years. This is due to the intuitive clarity of the risk-reward profile, where the maximum return is known in advance and the risk of loss is reduced compared to a direct investment. Furthermore, this product category is also suitable for a variety of market scenarios and often has very attractive return potentials – especially in volatile market phases.

How does a discount certificate work? The investor purchases a discount certificate at a price that offers a reduction (discount) compared to the price of the underlying. In return, the maximum payout of the certificate is limited; this limitation is defined by the cap. In exchange for the discounted purchase price, investors must accept that their participation in the underlying asset's positive performance is restricted up to the level of the cap.

In principle, the lower the cap, the higher the discount on the price of the underlying asset – and consequently the lower the risk and potential return. Defensive investors who aim to achieve a return even in

the event of a sideways movement of the underlying asset therefore opt for a cap below the current price of the underlying. A more offensive strategy would be to select a discount certificate with a cap above the current price of the underlying, which offers a reduced discount but greater participation in a rise in prices (lower buffer, higher potential returns).

Due to their risk-reducing character, discount certificates prove their strength especially in times of mildly rising, sideways moving, and moderately declining markets. However, by choosing a suitable cap, they can also be used well for market scenarios of rising prices; the extensive product offering allows investors to find a suitable discount certificate for almost every investment horizon and risk appetite.

Investors can find further information on the functioning, key figures, structure, price determinants and types of discount certificates in the DDV guide *Kompass Strukturierte Produkte* (in German only), which is available for download and free to order on the DDV website (www.derivateverband.de) in the *Publikationen* section.

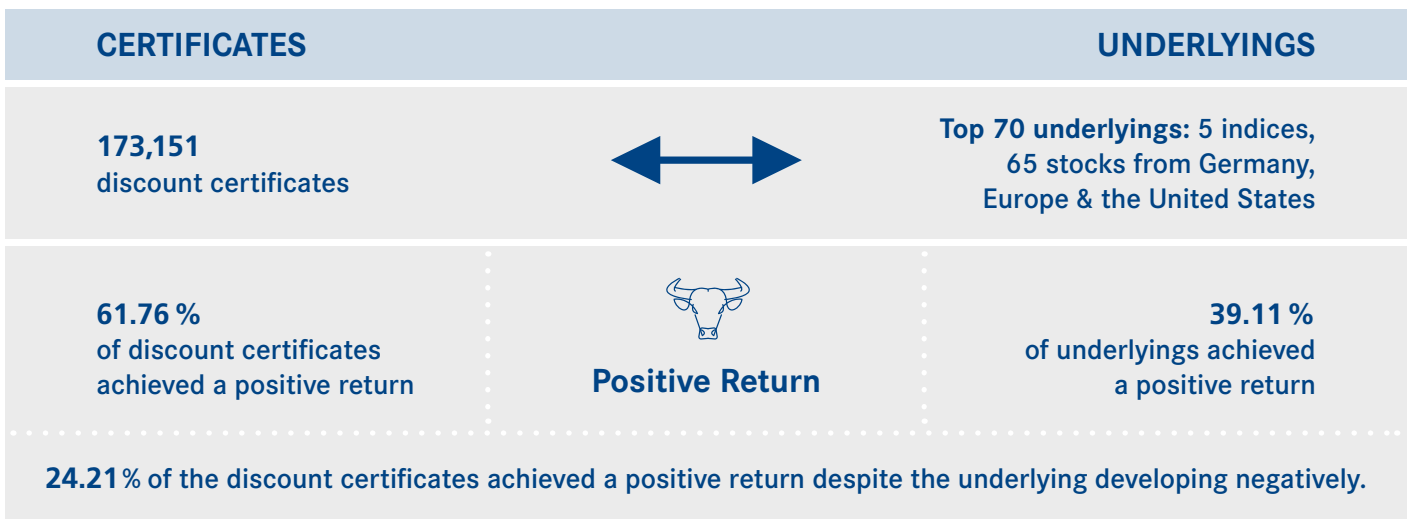


2 KEY FINDINGS

The purpose of this study is to compare the performance of investments in discount certificates with direct investments in the corresponding underlying assets by presenting key metrics that reflect risks and returns. The study is also intended to provide a comprehensive view of the vast product range available in the German market and the risk/reward profiles of discount certificates across various issuers.

A total of 173,151 discount certificates were analysed for the year 2022, covering the top 70 underlyings from Europe and the United States.

The findings indicate that investors who opt for discount certificates can navigate challenging market conditions with sharply falling prices better than those who choose direct investments in the underlying assets. This is because the discount granted can effectively cushion downward movements.



CERTIFICATES

UNDERLYINGS

-3.83 % p. a. (per annum)
average discount certificate
return



Average Return

-10.07 % p. a.
average underlying
return

Return by Region

+2.12 % p. a.
-3.85 % p. a.
-20.71 % p. a.

Europe (ex GER)
Germany
United States

-6.96 % p. a.
-7.75 % p. a.
-43.95 % p. a.



Outperformance

67.04 % of the discount certificates outperformed their underlying assets.



Maximum Return

Of the **67,986** certificates maturing in 2022 (= **39.26 %** of all analysed products),
49.62 % attained their maximum return.

The maximum return of these certificates was on average **7.02 % p. a.**



Maximum Return Probability

On average, the probability of a discount certificate achieving its maximum possible return was **61.43 %** on the first observation date.

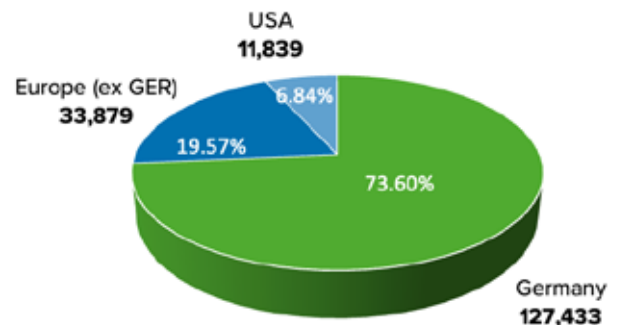
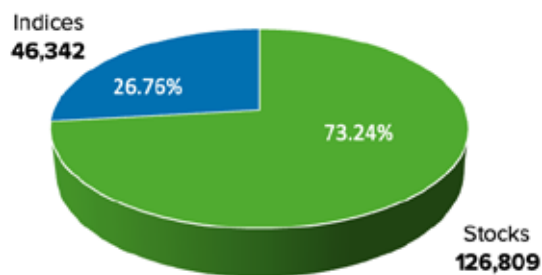
25.09 % of the discount certificates examined had a maximum return probability of at least **80 %** on the first observation date.

Of the discount certificates with a maximum return probability of at least **80 %** and maturing in 2022, **81.42 %** reached their maximum return at maturity.

3 SUBJECT OF EXAMINATION

TTMzero analysed 173,151 discount certificates, based on the 70 most popular underlyings from Germany (top 40), Europe-ex-Germany (top 20) and the United States (top 10).

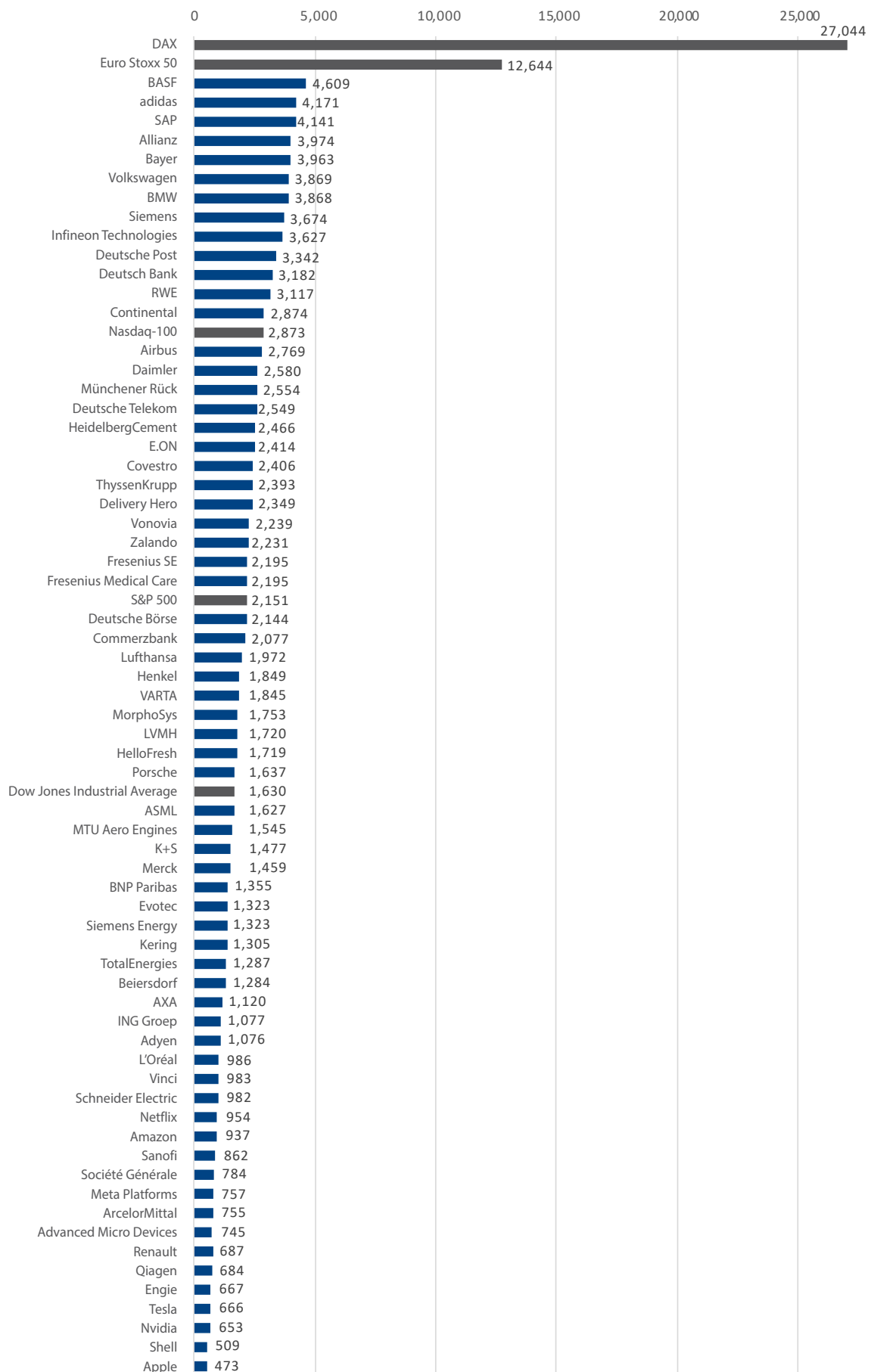
A total of 127,433 certificates were based on underlyings from Germany, 33,879 certificates were based on underlyings from Europe ex-Germany, and 11,839 certificates were based on underlyings from the United States.



Some 73.24% of the certificates were based on a stock as underlying and 26.76% of the certificates were based on an index.

The top 40 underlyings from Germany consisted of the DAX® index and 39 stocks. The top 20 underlyings from the rest of Europe comprised the EURO STOXX 50® index and 19 stocks. The US top 10 underlyings were formed by the Nasdaq-100®, S&P 500® and Dow Jones Industrial Average® indices, as well as seven individual stocks.

Chart 1: Underlying assets and number of discount certificates examined based on these underlying assets



4 ANALYSIS PERIOD AND METHODOLOGY

ANALYSIS PERIOD

For each discount certificate, the certificate return was compared with the underlying return in the respective observation period. The individual observation period for a certificate started with the first trading day of the certificate in 2022 and ended with the last trading day of the certificate in 2022. The following assumptions apply:

Assumptions calculating the certificate return

The entry price was defined as the first ask price on the first trading day of the certificate. For certificates issued after 1 January 2022, the first price on the first trading day was defined as the entry price.

The last bid price on the last trading day in 2022 was defined as the exit price. If the certificate matured during the year 2022, the exit price was the redemption amount.

Calculation of key figures

The key figures (sideways return, maximum return, implied volatility, relative discount, relative distance to cap and maximum return probability) were calculated on the first trading day of the discount certificate in 2022.

As a rule, the first ask price of the day was used to calculate the key figures. The mid-price between the first bid and ask price was used to calculate the implied volatility.

Assumptions for calculating the underlying return in the observation period

The return of the underlying asset was calculated from the opening price of the underlying asset on the first observation date of the certificate and the closing price of the underlying asset on the last observation date of the certificate in 2022.

When calculating the return of the underlying instrument, prices were adjusted for corporate actions (dividends, stock splits, etc.).

For underlyings not denominated in euros, the performance was adjusted for the exchange rates valid on the specific day.

5 RESULTS IN DETAIL

1 Comparison of Returns: Discount Certificates vs. Underlyings

Discount certificates outperformed their underlyings in the challenging market environment of 2022:

Overall, 61.76% of the discount certificates achieved a positive performance. For the respective underlyings, 39.11% achieved a positive performance.

Some 24.21% of the discount certificates achieved a positive return during the period under review despite the underlying asset performing negatively during the same period.

Of the discount certificates maturing in 2022, 49.62% achieved their maximum return, with an average maximum return of 7.02% p.a.

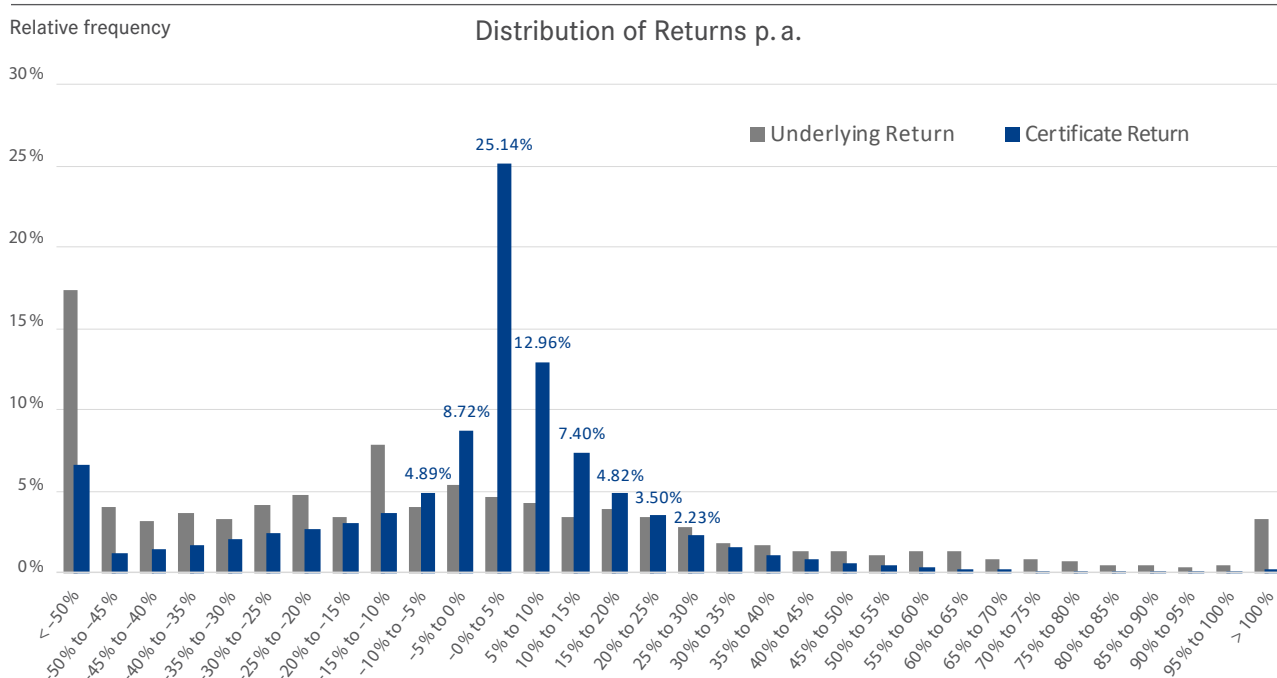
A total of 67.04% of the discount certificates generated a higher return than a direct investment in the respective underlying asset would have generated in the same period.

The average return of the discount certificates in the period under review was -3.83% p.a., whereas that of the underlyings was -10.07% p.a.

Certificate returns in detail:

- **25.14%** of discount certificates generated returns between **0%** and **5%** p.a.
- **12.96%** generated returns between **5%** and **10%** p.a.
- **7.40%** of the discount certificates had returns between **10%** and **15%** p.a.
- **4.82%** of the certificates generated returns between **15%** and **20%** p.a., and **3.50%** between **20%** and **25%** p.a.
- **7.95%** of the certificates generated returns of more than **25%** p.a.
- **38.24%** generated negative returns.

Chart 2: Comparison of the distribution of returns of discount certificates and underlyings



2 Distributions and Averages of Key Figures

The following key figures were calculated on the first trading day of each discount certificate in 2022.

2.1 Remaining Maturity

The discount certificates under review had an average remaining term of 332 days. Some 67,986 of the certificates under review (i.e., 39.26%) matured in 2022.

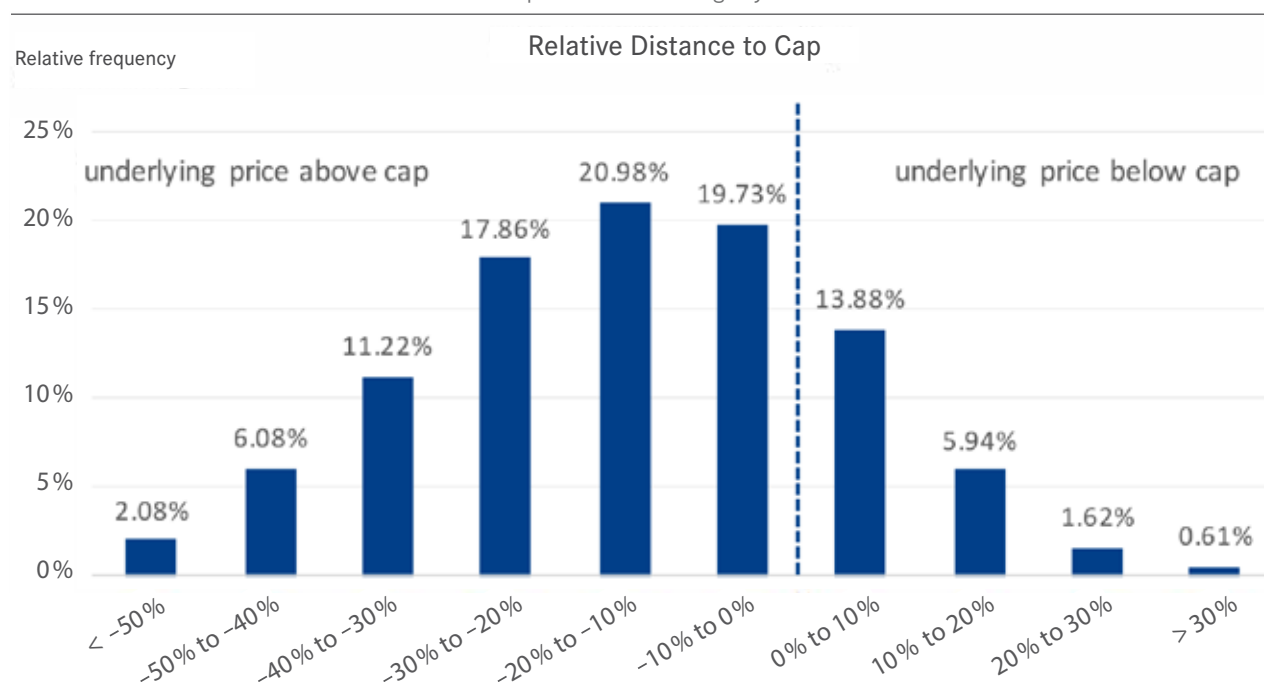
2.2 Relative Distance to Cap (Distance in %)

Since the cap in relation to the purchase price determines the maximum return a discount certificate can achieve, this parameter is highly significant for investors.

The relative distance to the cap shows how far the price of the underlying asset is away from the cap on the first observation date. A positive distance (cap above the underlying price) generally indicates a more offensive strategy with higher return potential and lower buffer.

If, on the other hand, the cap is below the underlying price (negative distance, defensive strategy), the discount is higher and the risk (but also the potential return) is lower.

Chart 3: Distribution of the relative distance to the cap on the first trading day of each certificate



In 2022, the average distance to the cap on the first observation date was -14.25%.

In total, 77.96% of discount certificates had a negative distance to the cap on the first observation date (underlying price > cap). If the price of the underlying is above the cap at the beginning of the observation period, a sideways movement of the underlying price is enough for investors to achieve the maximum return.

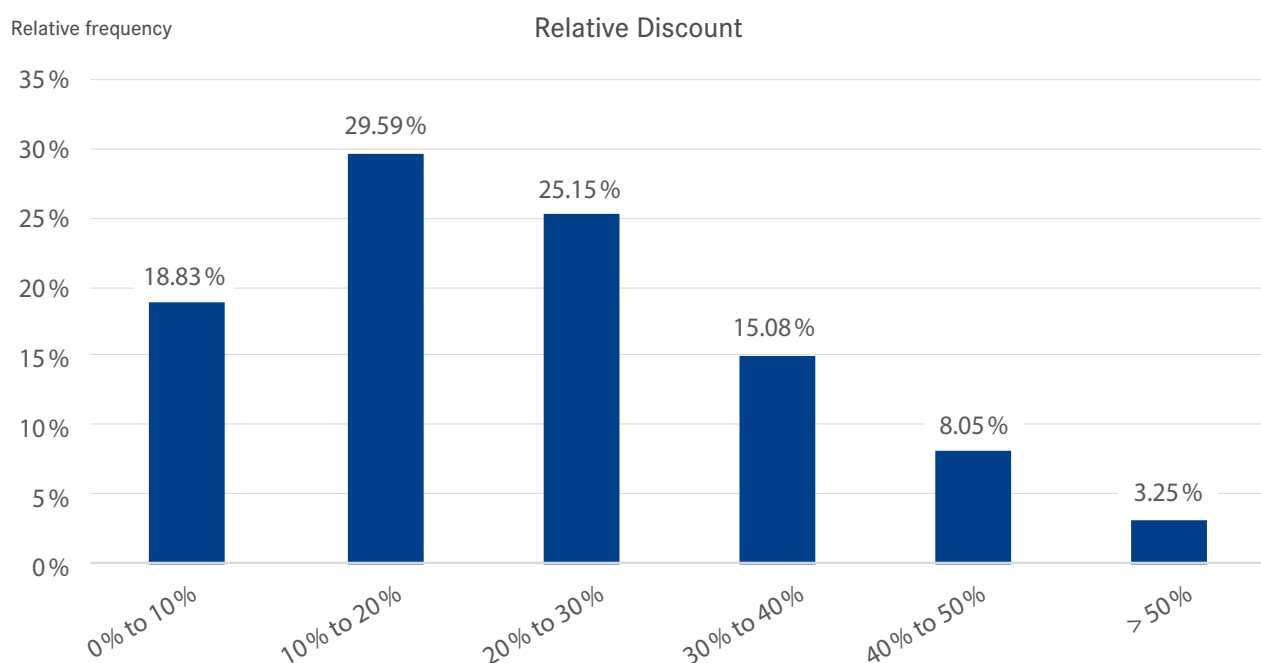
Of the 77.96% of certificates with a negative distance to the cap on the first observation date, 72.56% also had a negative distance to the cap on the last observation date, which means they maintained their maximum return.

2.3 Relative Discount (Discount in %)

The relative discount helps investors to assess the extent of the buffer effect of the discount certificate against price losses of the underlying.

The relative discount corresponds to the percentage discount of the certificate's price compared to a direct investment in the underlying instrument. The lower the cap is compared to the underlying price, the higher the discount that is granted to a certificate.

Chart 4: Distribution of the relative discount*



* 0.05% of the certificates under review had a negative relative discount.

The discount certificates under review had an average discount of 22.41% on the first observation date.

In total, 18.83% of the certificates had a discount of below 10%, 29.58% between 10% and 20%, and 25.15% of the certificates between 20% and 30%. Some 26.39% of the certificates had a discount of over 30%.

2.4 Maximum Return p. a.

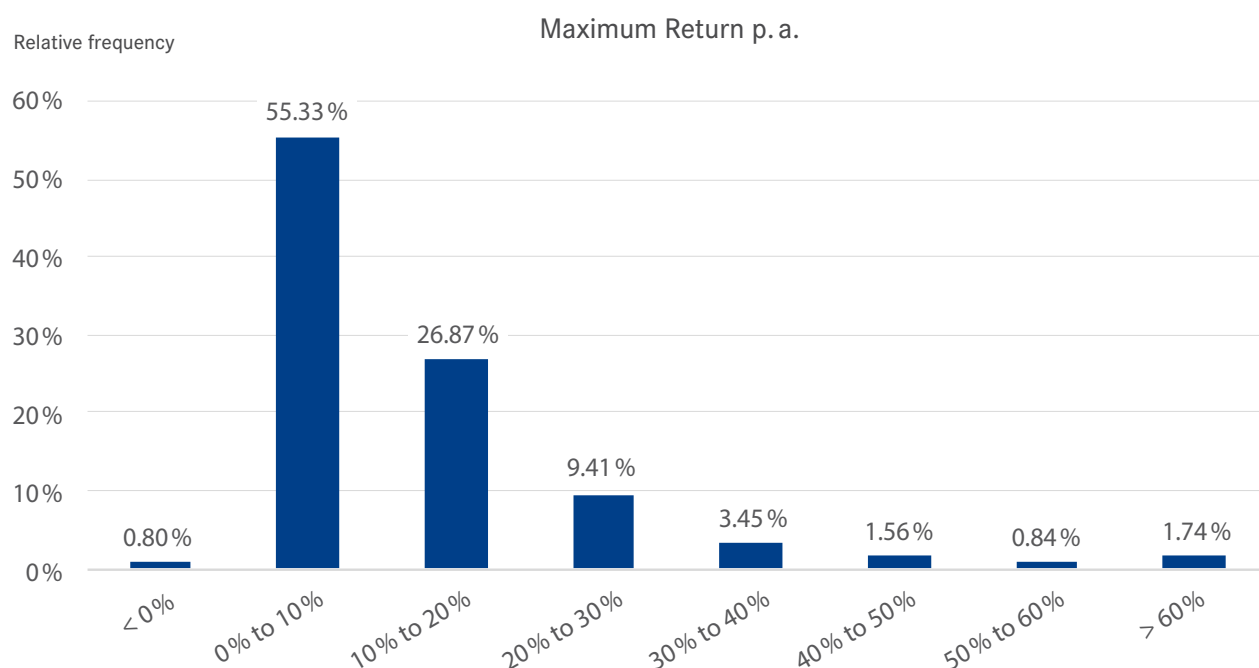
The maximum return corresponds to the maximum possible return of a discount certificate until maturity. By annualising these returns, the maximum return p. a. is obtained.

The maximum annual return is determined by the selected cap level and the remaining maturity. A cap substantially above the underlying asset's price indicates a high potential maximum return, but also a lower discount, which translates to higher risk.

In the study, the potential maximum return p. a. was determined based on the first observation date.

Some 55.33% of the discount certificates had the chance to achieve a maximum return of 0% to 10% p. a., 26.88% of 10% to 20% p. a., and 16.99% of the certificates had the chance to achieve a maximum annual return of more than 20% p. a., thereof 1.74% of more than 60% p. a.

Chart 5: Distribution of maximum returns p. a.



On the first observation date in 2022, potential maximum returns between 0% and 10% p. a. were by far the most frequent.

The average potential maximum return was 13.18% p. a.

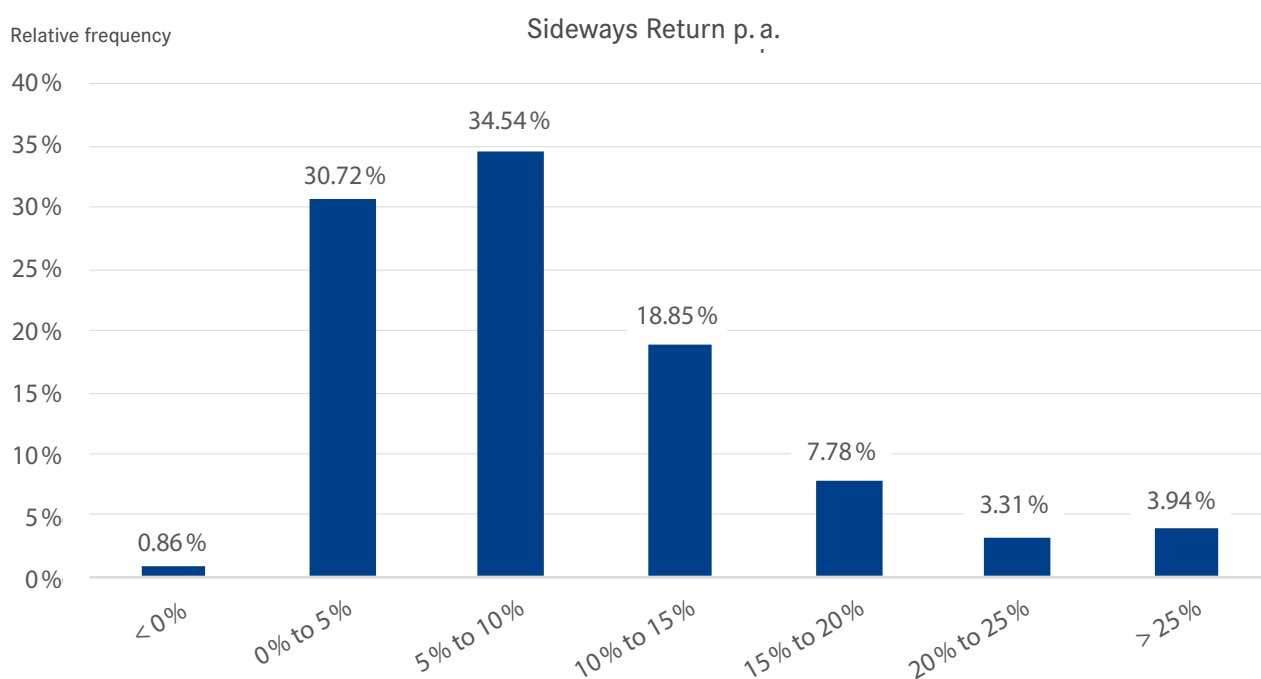
Of all certificates maturing in 2022, 49.62% reached their maximum return.

2.5 Sideways Return p. a.

The sideways return indicates the return achieved by the discount certificate if the underlying asset is quoted at the same level at maturity as the level on the first observation date.

In our analysis, 30.72% of the discount certificates under review had a sideways return between 0% to 5% p. a., 34.54% between 5% and 10% p. a., 18.85% between 10% and 15% p. a., and 15.03% had a sideways return of more than 15% p. a.

Chart 6: Distribution of annualised sideways returns



Discount certificates play to their strengths in sideways-moving or slightly falling markets.

In 2022, they would have achieved an average sideways return of 9.17% p. a.

By choosing the right cap, discount certificates can also be used for scenarios of rising markets and may achieve very good returns.

2.6 Implied Volatility

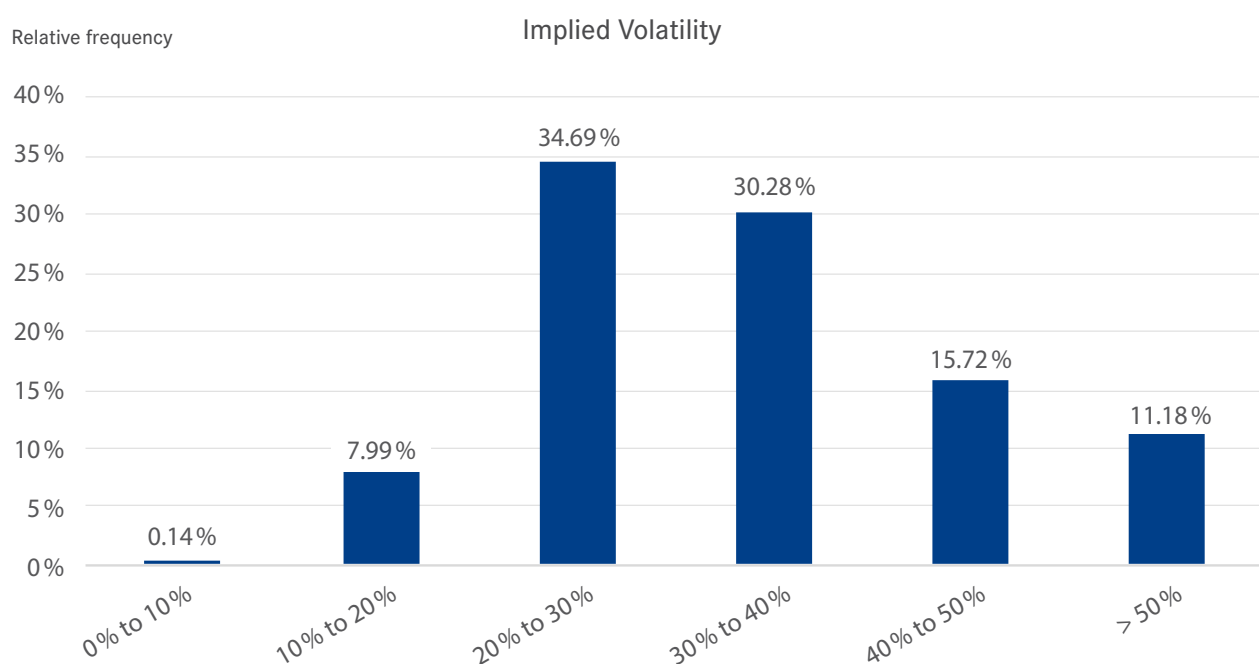
The implied volatility provides information about the expected fluctuations of the underlying asset and serves investors as a measurement of the uncertainty of an investment: Investors typically view higher implied volatility as an indicator of greater price fluctuation likelihood.

Consequently, the higher the expected fluctuation, the greater the price markdown of a discount certificate compared to the underlying asset. However, this also implies a higher risk for the certificate. For guidance, investors can compare the implied volatilities of

various stocks against one another or against implied volatilities of the indices.

Among the discount certificates examined, 7.99% of the discount certificates had an implied volatility of 10% to 20%, 34.69% of the products showed an implied volatility between 20% and 30%, 30.28% of the certificates fell in the range of 30% to 40%, while 15.72% of the instruments had a volatility between 40% to 50%. For 11.18% of the certificates, the implied volatility was greater than 50%.

Chart 7: Distribution of implied volatilities



The average implied volatility in 2022 was 34.69% on the first observation date of the certificates.

Maximum Return Probability

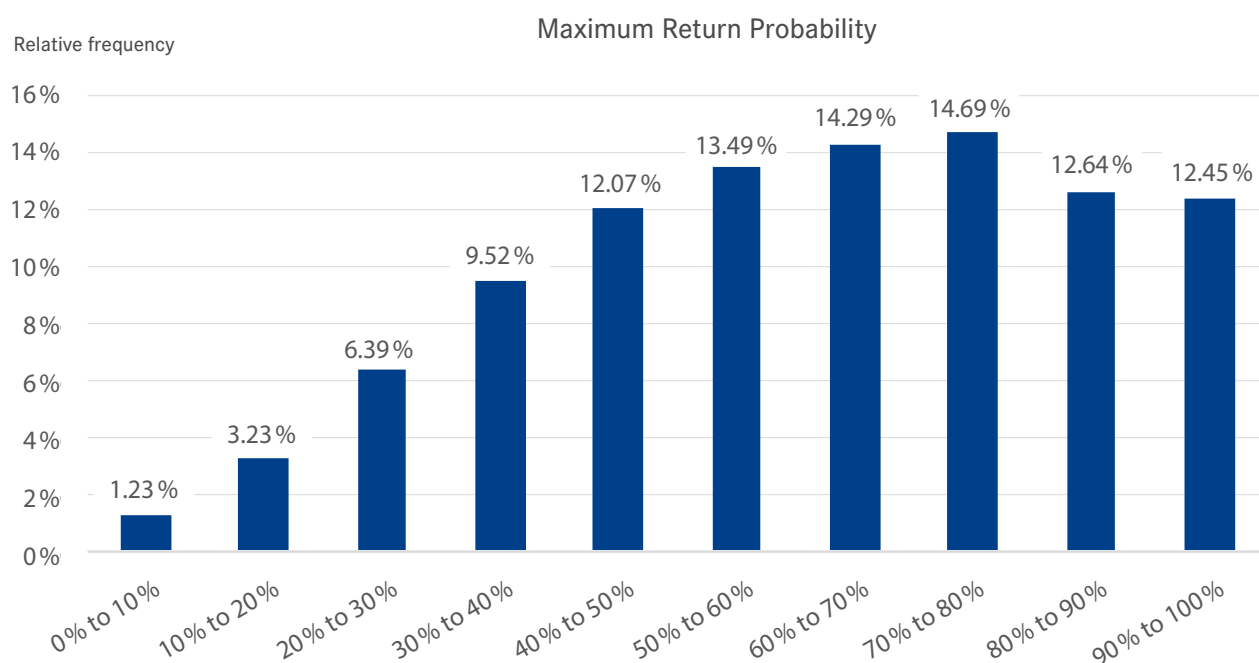
The maximum return probability reflects the likelihood with which the price of the underlying asset will be at or above the cap on the valuation date – and with which investors thus achieve the maximum return.

The higher the maximum return probability, the higher the underlying price usually is above the cap. How-

ever, due to the comparatively lower risks involved, the maximum returns that can potentially be obtained are typically lower than those with similar certificates having a lower maximum return probability.

Conversely, if the maximum return probability is low, the certificate has the chance to achieve a higher return, but also comes with higher risk.

Chart 8: Distribution of Maximum Return Probability



In 2022, the average maximum return probability of the examined certificates was 61.43%.

Some 67.56 % of the certificates had a maximum return probability of over 50%, and 25.09% of over 80%.

Of the certificates with a maximum return probability above 50% and maturing in 2022, 62.14% attained their maximum return. Of the maturing certificates with a maximum return probability of above 80%, 81.42% reached their maximum return.

6

DESCRIPTION OF THE MARKET AND LICENSE INFORMATION

DESCRIPTION OF THE MARKET FOR DISCOUNT CERTIFICATES

In Germany, the volume invested in structured products amounted to around 80.5 billion euros at the end of 2022. Discount certificates accounted for approximately 4.8% of this total. (Source: DDV).

At the Stuttgart, Frankfurt and gettex stock exchanges, the volume traded in investment products amounted to 13.753 billion euros in 2022. Discount certificates accounted for 6.058 billion euros of this total. This corresponds to a share of 44.05%.

A total of 378,697 investment products were listed in Stuttgart as at 31 December 2022, of which 163,223 were discount certificates.

The relatively high share of discount certificates in the total investment products reflects the high attractiveness of this product category in Germany.

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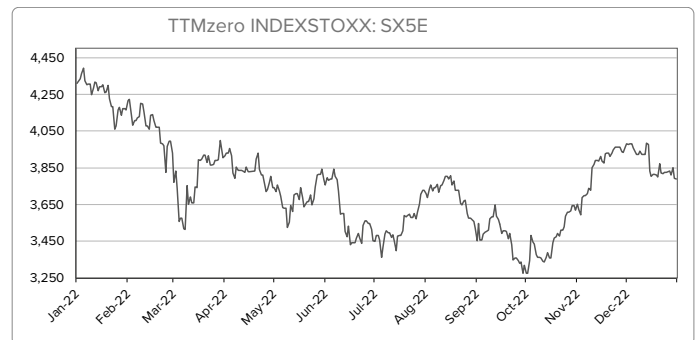
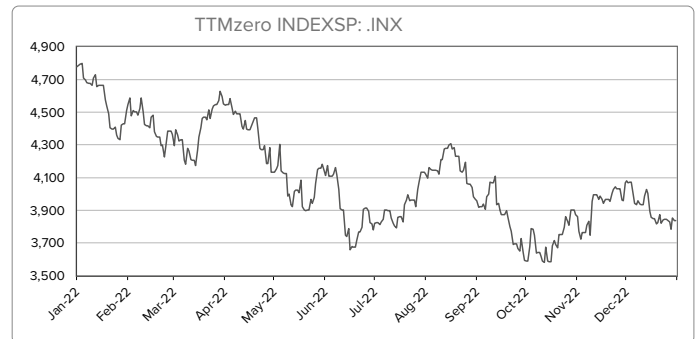
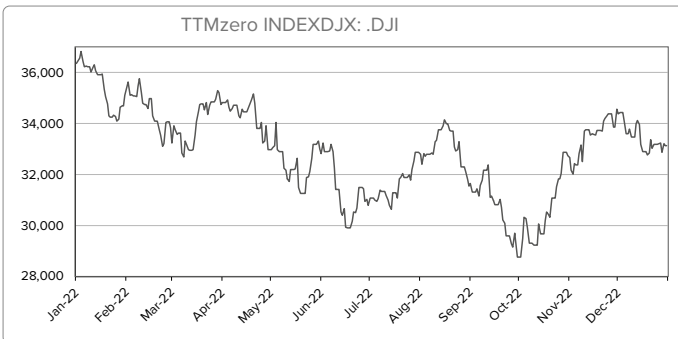
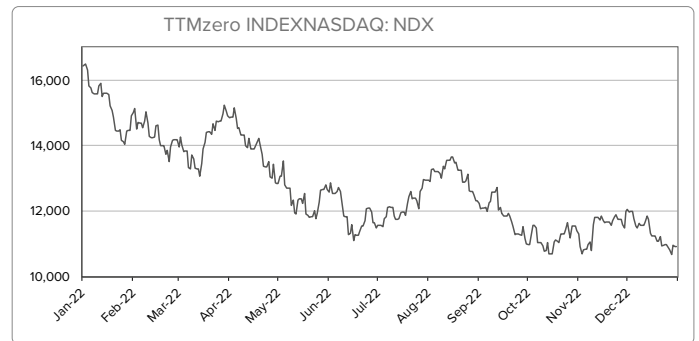
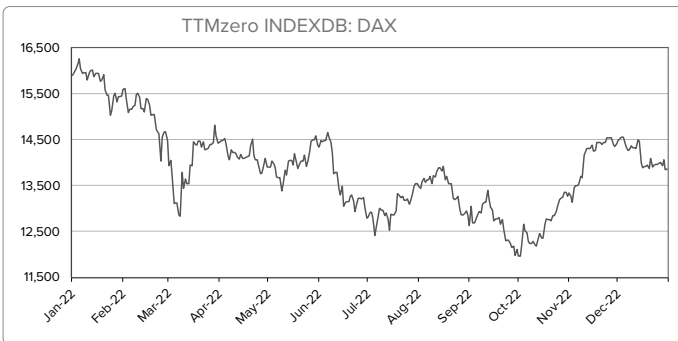
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7 PERFORMANCE OF THE FIVE INDICES

PERFORMANCE OF THE FIVE INDICES

All five indices that were among the examined underlying assets performed negatively in 2022, with varying degrees of divergence. The Nasdaq-100, for example, had the worst result with a decline of around 34%, while the Dow Jones only decreased by 9%.



The charts are based on real-time estimates calculated by TTMzero.



TTMZERO, BOERSE STUTTGART GROUP AND THE DDV

The study was conducted by TTMzero together with the Boerse Stuttgart Group on behalf of the German Derivatives Association (DDV).

TTMzero is a Berlin-based company founded in 2013 that provides data products and software solutions in the field of RegTech and Capital Markets Tech. The company specialises in developing cost-effective, proprietary solutions that help financial institutions manage risks, comply with regulatory requirements, value financial instruments, and automate their structured product issuance processes.

TTMzero is part of **United Fintech Ltd.** which has offices in New York (US), London (UK), Copenhagen (DK), Berlin (DE), Madrid (ES), Singapore and Craiova (RO).

TTMzero calculated the key figures presented in the study in real-time for all discount certificates. The real time data is published by some of the leading issuers and is available on major broker platforms and finance portals such as traderepublic.com and wallstreet-online.de.

Boerse Stuttgart Group operates the leading floor trading venue and private investor exchange in Germany through the Stuttgart Stock Exchange. Investors have access to a wide range of tradable securities such as stocks, securitised derivatives, bonds, ETFs, funds, and profit participation notes.

The Stuttgart Stock Exchange is the European market leader in exchange trading with securitised derivatives and the German market leader in the corporate bond segment. In the hybrid market model of Stuttgart Stock Exchange, trading experts ensure reliable and fast order execution.

All regulatory and control mechanisms of a public stock exchange are in place to ensure investor protection and transparency.

In 2022, the Stuttgart Stock Exchange had a trading volume of approximately 90.7 billion euros in all asset classes.

ABOUT THE DDV

Deutscher Derivate Verband (DDV), the German Derivatives Association, is the industry representative body for the leading issuers of structured securities in Germany: Barclays, BNP Paribas, Citigroup, Deka-Bank, Deutsche Bank, DZ BANK, Goldman Sachs, HSBC Trinkaus, HypoVereinsbank, J.P. Morgan, LBBW, Morgan Stanley, Société Générale, UBS and Vontobel. Furthermore, the Association's work is supported by over 20 sponsoring members, including the Stuttgart and Frankfurt Exchanges, gettex, Baader Bank, the direct banks comdirect bank, Consorsbank, DKB, flatexDEGIRO, ING-DiBa, maxblue, S Broker, Smart-broker and Trade Republic, as well as finanzen.net, onvista and various other service providers.

The DDV strives to play an active role in shaping the political and regulatory framework for structured products in Germany and Europe. The Association is committed to ensuring standards, transparency, and clarity in the structured products market and product communication. This includes publications and papers on financial education, such as the Discount Study and the guide *Kompass Strukturierte Produkte* (available only in German), which cater to both self-directed and advised investors. The Discount Study was commissioned by the DDV for the fourth time.

9

IMPORTANT NOTES

For the above information, the sources available and considered reliable were used. Statements based on these sources represent a non-binding estimate at the time this document was prepared.

The investment products considered in this document are not suitable for every investor, as they may also result in substantial losses. Individual advice from an investment advisor is recommended.

The authors of the study make no representations or warranties with regard to the results. In no way are the securities discussed in the study recommended or advertised. The information contained herein does not constitute investment advice. The complete information as well as the risks relating to the discount certificates examined can be found in the respective base prospectuses and any supplements thereto, as well as in the respective Final Terms.

