

STUDY ON DISCOUNT CERTIFICATES IN 2019

CONDUCTED BY TTMZERO AND BÖRSE STUTTGART
ON BEHALF OF THE GERMAN DERIVATIVES ASSOCIATION
(DEUTSCHER DERIVATE VERBAND, DDV)

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STUDY ON DISCOUNT CERTIFICATES IN 2019

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2 SUMMARY

Subject of the investigation

187,107 discount certificates, based on the Top 70 underlyings from Europe and the USA

Investigation period

1 January 2019 to 31 December 2019

88.37%	of the discount certificates achieved a positive yield over the period considered
80.73%	of the corresponding underlyings generated a positive yield in the same period
37.13%	of the discount certificates achieved a higher yield than its underlying asset in the relevant period
8.37%	of the discount certificates achieved a positive yield in the period under review, while the underlying developed negatively
14.13%	was the average yield of the discount certificates under review
43.68%	of the certificates had a probability of more than 50% on the first observation date for reaching the maximum yield (Maximum Yield Probability)
98.65%	of certificates maturing in 2019 which had a Maximum Yield Probability of at least 80% on their first observation date reached their maximum yield.

The above data refer to the analyzed discount certificates in the period under review. More details on the assumptions of the analysis can be found in the following chapters.

3 INTRODUCTION AND SUBJECT OF EXAMINATION

INTRODUCTION

In cooperation with the Stuttgart Stock Exchange ("Börse Stuttgart"), TTMzero analyzed 187,107 discount certificates for the year 2019. The examined certificates refer to the top 70 underlyings from Europe and the USA.

The objective of this study is to compare investments in discount certificates with direct investments in the corresponding underlying asset in terms of yield attractiveness. The returns realized on certificates and those on underlyings during the period under review were compared for this purpose.

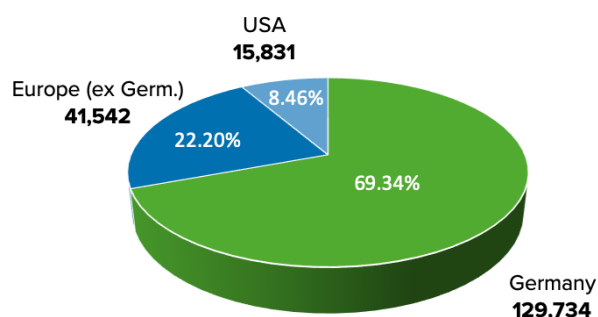
Furthermore, the study describes the large number of discount certificates in the German market and provides investors with a good overview of the opportunities and risks with respect to the discount certificates.

In order to enable a comparison across issuers, the key figures Sideways Yield, Maximum Yield, Implied Volatility, Maximum Yield Probability, Relative Distance to Cap, Relative Discount and Delta were calculated and examined for all discount certificates.

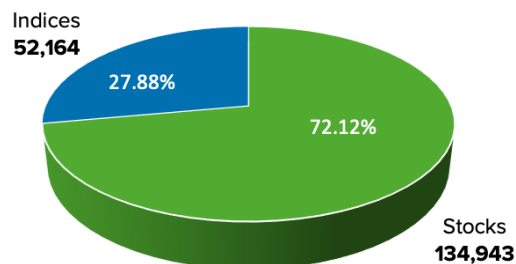
SUBJECT OF EXAMINATION

TTMzero analyzed 187,107 discount certificates, which are based on the 70 most popular underlyings from Germany (Top 40), Europe-ex-Germany (Top 20) and the USA (Top 10).

129,734 certificates were based on underlyings from Germany, 41,542 certificates were based on underlyings from Europe ex-Germany and 15,831 certificates were based on underlyings from the USA.



72.12% of the certificates were based on a stock as underlying and 27.88% of the certificates were based on an index.



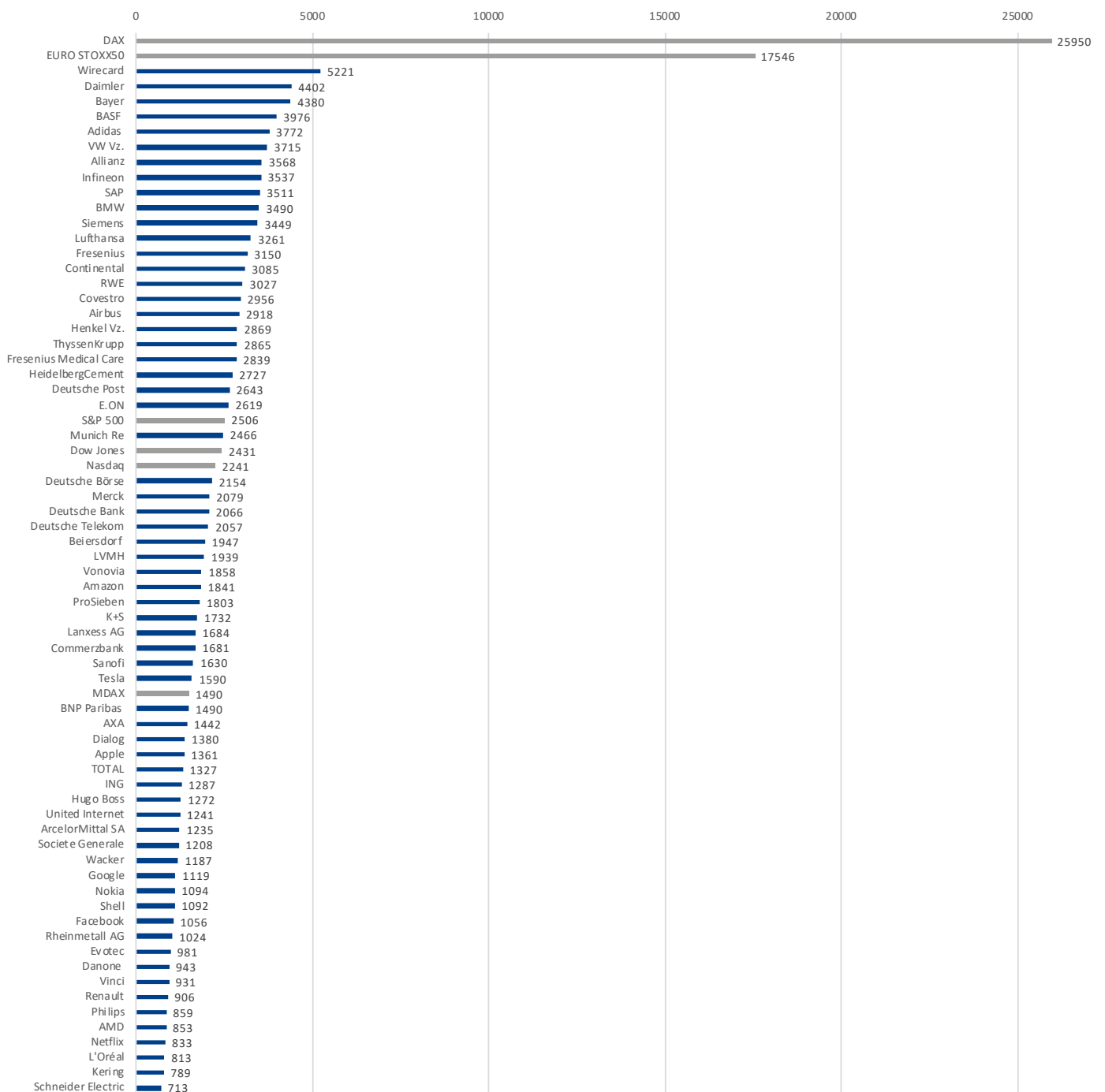
SUBJECT OF EXAMINATION

The top 40 underlyings from Germany consist of 38 stocks and the two indices DAX® and MDAX®. The top 20 underlyings from the rest of Europe consist of 19 equities and the EURO STOXX 50® Index. The American top 10 underlyings include seven equities

and the three indices NASDAQ 100®, S&P 500®, and Dow Jones Industrial Average®.

The underlyings are listed in the following overview.

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 yield was compared with the underlying yield in the respective observation period. The individual observation period for a certificate starts with the first trading day of the certificate in 2019 and ends with the last trading day of the certificate in 2019. The following assumptions apply:

Assumptions calculating the certificate yield

The entry price is defined as the first ask price on the first trading day of the certificate. For certificates issued after 1 January 2019, the first price on the first trading day is defined as the entry price.

The last bid price on the last trading day in 2019 is defined as the exit price. If the certificate matures during the year 2019, the exit price is the redemption amount.

Calculation of key figures

The certificate key figures (sideways yield, maximum yield, implied volatility, delta, relative discount, relative distance to cap and maximum yield probability) are calculated on the first trading day of the discount certificate in 2019.

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 delta and the implied volatility.

Assumptions for calculating the underlying yield in the observation period

The yield of the underlying asset is calculated from the opening price of the underlying asset on the first observation day of the certificate and the closing price of the underlying asset on the last observation day of the certificate in 2019.

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

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

5 RESULTS

1 Comparison of Yields: Discount Certificates vs. Underlyings

Overall, 88.37% of the discount certificates achieved a positive performance. For the respective underlyings, 80.73% achieved a positive performance.

8.37% of the discount certificates achieved a positive yield during the period under review, while the underlying asset performed negatively during the same period.

Of the discount certificates maturing in 2019, 67.41% achieved their maximum yield. The average yield of the discount certificates maturing in 2019 was 22.46% p.a.

37.13% of the discount certificates generated a higher yield than a direct investment in the respective underlying asset would have generated in the same period.

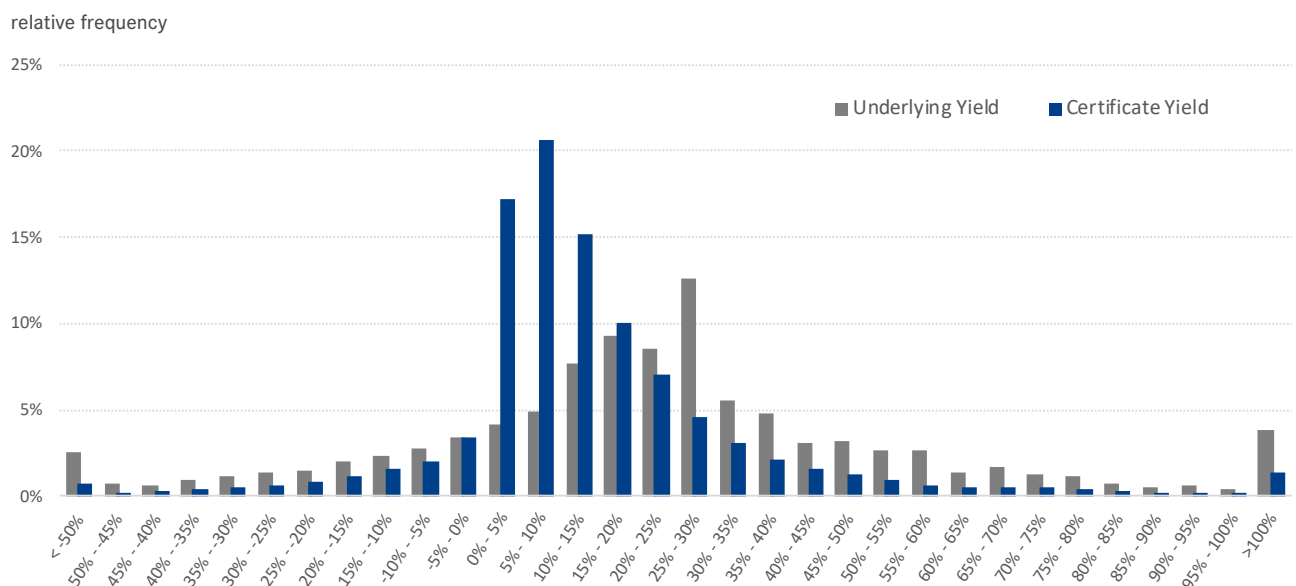
The average yield of the underlyings in the period under review was 23.96% p.a., whereas that of discount certificates was 14.13% p.a. The reason for this is that many underlyings realized a high performance in the strong market environment of 2019, while the performance of discount certificates was limited to the maximum yield, i.e. the cap.

Certificate yields in detail:

- **17.21%** of discount certificates generated yields between **0% and 5% p.a.**
- **20.68%** generated yields between **5% and 10% p.a.**
- **15.20%** of the discount certificates have yields between **10% and 15% p.a.**
- **10.02%** of the certificates generated yields between **15% and 20% p.a.**
- **7.06%** between **20% and 25% p.a.**
- **18.20%** of the certificates generated yields of more than **25% p.a.**

The distribution of yields of the discount certificates under review and their underlyings is shown in the graphs below.

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



RESULTS

2 Distributions and Averages of Certificate Key Figures

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

2.1 Maturity

The discount certificates under review had an average remaining term of 379 days.
65,802 certificates were due in 2019.

2.2 Relative Distance to Cap

The relative distance to the cap shows how far the price of the underlying asset is from the cap and whether it is above or below it, i.e. whether it is negative or positive.

56.70% of the discount certificates had a negative distance to the cap on the first observation day, i.e. the price of the underlying instrument was above the cap.

In 43.30% of the cases, the price of the underlying instrument was below the cap. The distance to the cap was therefore positive.

43.92% of the certificates had a distance to the cap between -10% and +10%.

The average distance to the cap was -2.41%.

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



RESULTS

2.3 Relative Discount

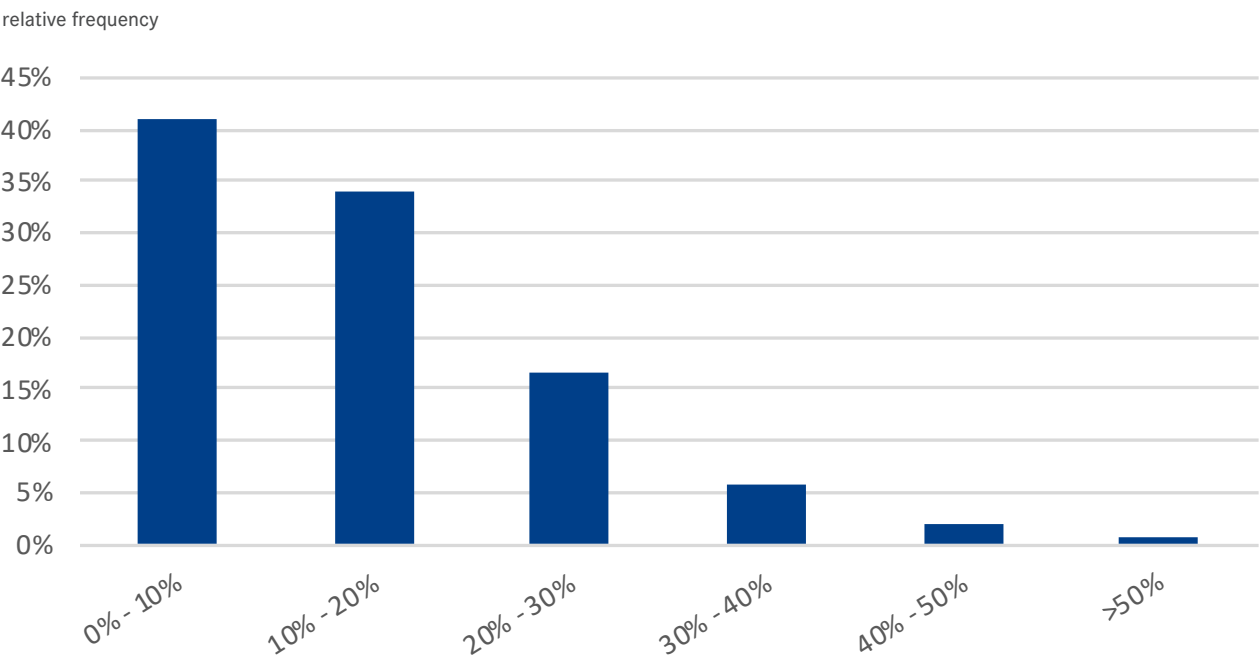
The relative discount corresponds to the percentage discount of the certificate's price compared to a direct investment in the underlying instrument.

The discount certificates under review had an average discount of 14,24% on the first observation day.

In total, 40.99% of the certificates had a discount below 10%, 34.14% had a discount between 10% and

20% and 16.45% of the certificates had a discount between 20% and 30%;
8.42% of the certificates had a discount of over 30%.
The exact distribution is as follows:

Chart 4: Distribution of the relative discount *)



*) 0.04% of the certificates under review had a negative relative discount

RESULTS

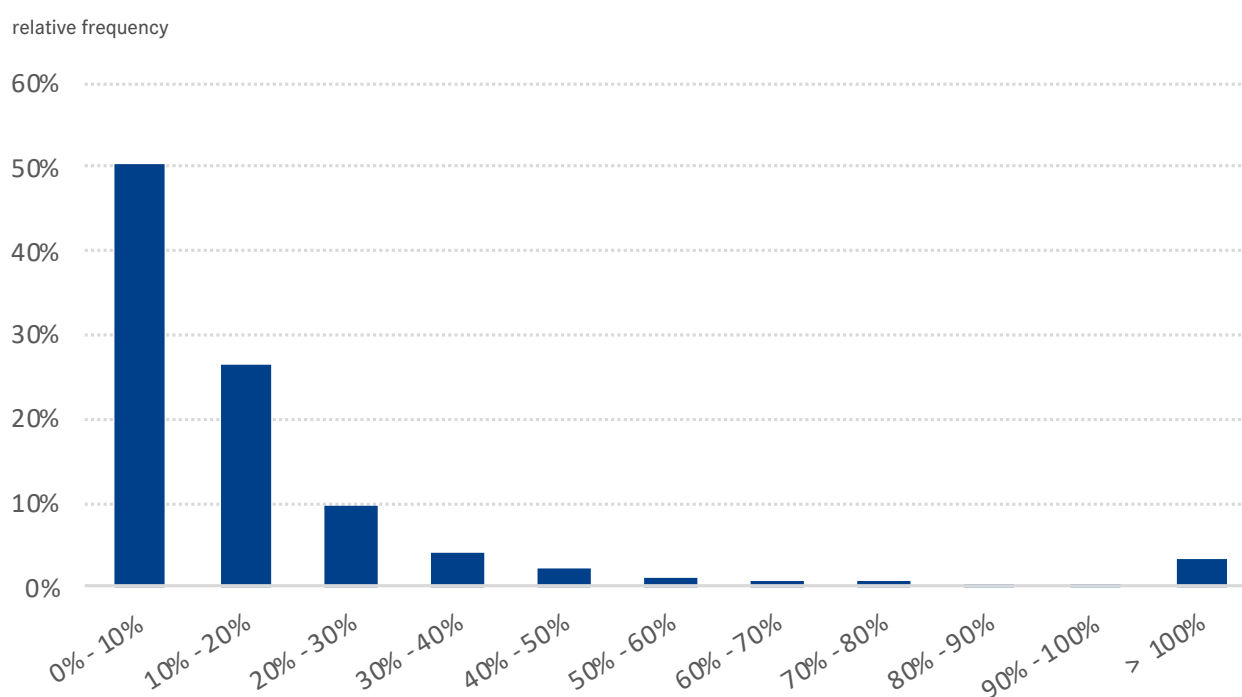
2.4 Maximum Yield p.a.

The maximum yield corresponds to the maximum possible yield of a discount certificate until maturity. By annualizing those yields, the maximum yield p.a. is obtained.

Looking at the possible maximum yield p.a. on the first observation day, the following picture emerges:

- 50.49% of the discount certificates had the chance of a maximum yield of up to 10% p.a.
- 26.64% of the certificates had a chance of a possible maximum yield of 10% to 20% p.a.
- 22.87% of the certificates had the chance of a maximum annual yield of more than 20% p.a., thereof 5.69% of more than 60% p.a.
- The average maximum yield on the first observation day was 23.33% p.a.

Chart 5: Distribution of maximum yields p.a. *)



*) 0.14% of the certificates under review had a negative maximum yield p.a.

For comparison:

67.41% of the certificates maturing in 2019 achieved their maximum possible yield.
The average of yields achieved on all certificates due in 2019 was 22.46% p.a.

RESULTS

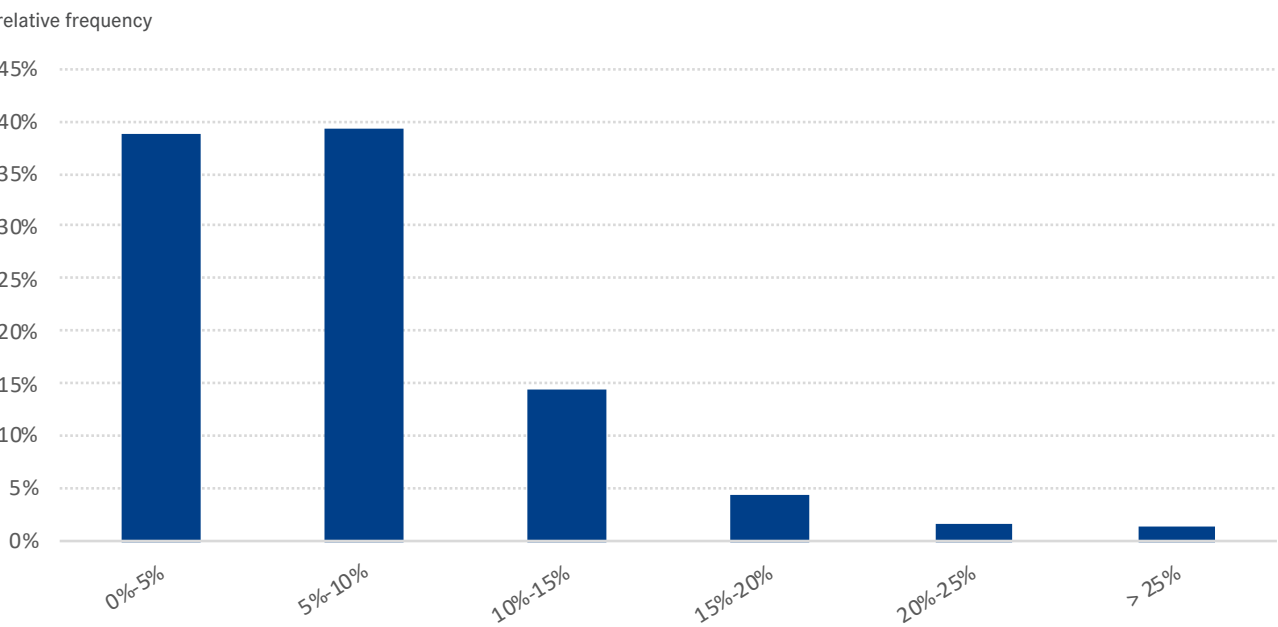
2.5 Sideways Yield p.a.

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

In our analysis, 39.01% of the discount certificates under review had a sideways yield of up to 5% p.a., 39.16% had a yield between 5% and 10% p.a., 14.38%

between 10% and 15% p.a. and 7.45% had a sideways yield of more than 15% p.a. The average sideways yield was 7.26% p.a.

Chart 6: Distribution of annualized sideways yields *)



*) 0.18% of the certificates under review had a negative annualized sideways yield

RESULTS

2.6 Implied Volatility

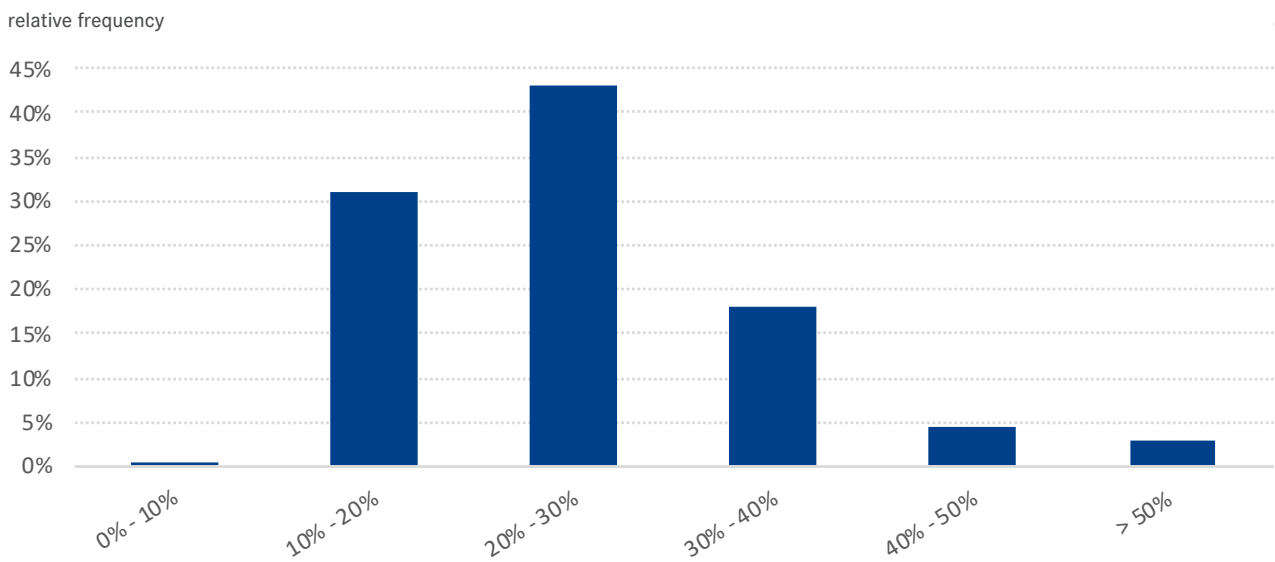
The implied volatility provides information about the expected fluctuations of the underlying. The higher this value is, the higher the price markdown for discount certificates.

Among the discount certificates examined, 0.51% of the discount certificates had an implied volatility of 0% to 10%, 31.07% from 10% to 20%, 43.14% between

20% and 30% and 18.06% from 30% to 40%. For 7.22% of the certificates the implied volatility was greater than 40%.

The average implied volatility was 25.67%.

Chart 7: Distribution of implied volatilities



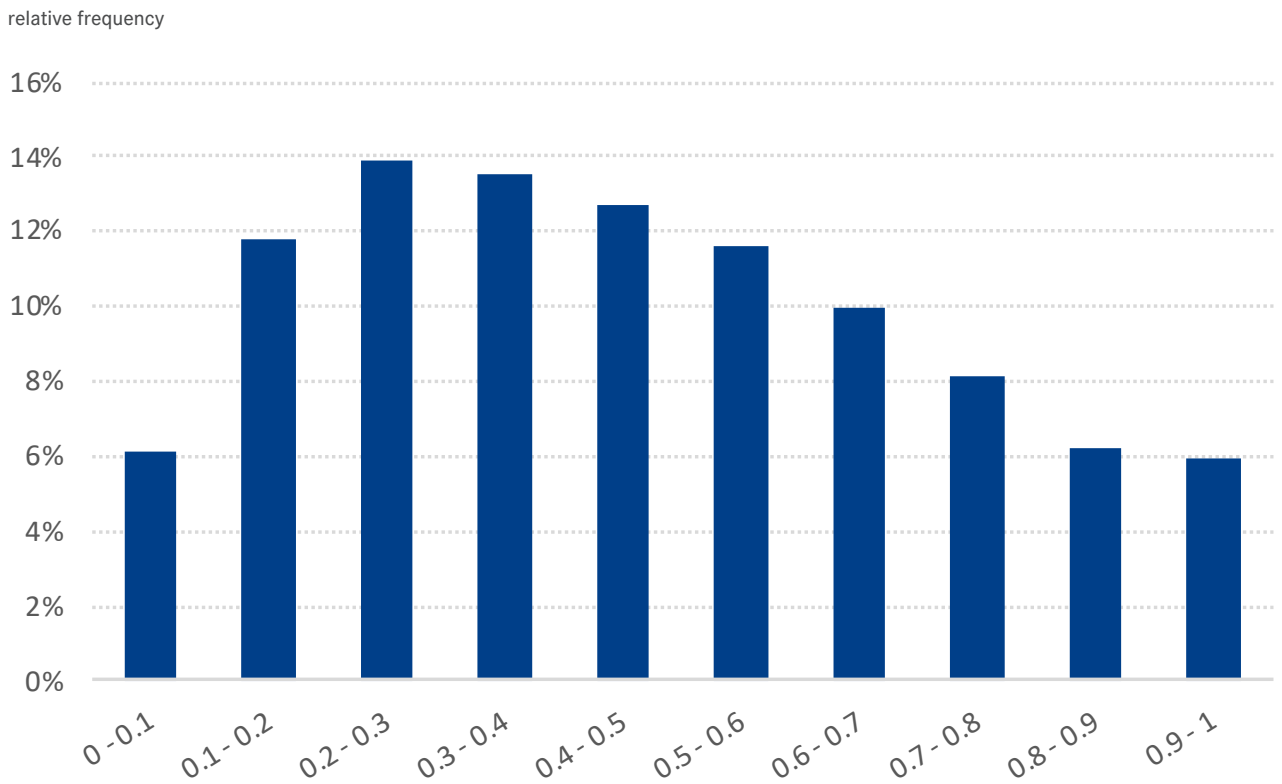
RESULTS

2.7 Delta

The delta indicates how the price of the discount certificate changes if the price of the underlying increases by one unit. For better understanding, the study adjusted the delta for certificates based on underlyings in foreign currencies by the exchange rates (pure delta).

- 6.16% of the discount certificates under review had a delta of less than 0.1.
- 5.93% of the certificates had a delta of more than 0.9.
- 51.95% had a delta between 0.1 and 0.5.
- The average delta was 0.46.

Chart 8: Distribution of the delta



RESULTS

2.8 Maximum Yield Probability

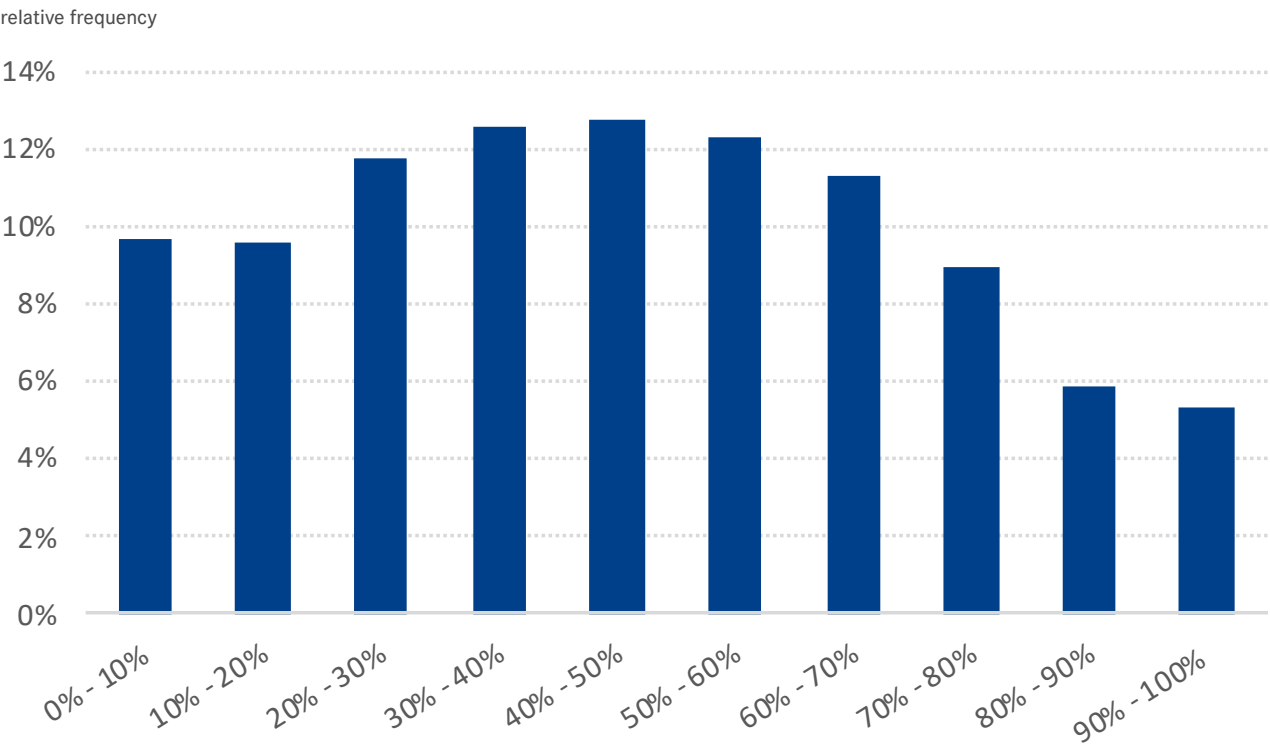
One of the most important indicators for discount certificates is the Maximum Yield Probability.

It provides information about the probability of a discount certificate to achieve the maximum yield at maturity. In other words: The Maximum Yield Probability gives information about the probability that the price of the underlying asset is at or above the cap on the valuation day of the discount certificate.

The following picture emerges for the discount certificates examined:

- For 43.68% of the certificates, on the first observation day the probability of reaching the maximum yield was above 50%.
- For 5.34% of the certificates, the probability of reaching the maximum yield was over 90%
- The average maximum yield probability of the analyzed certificates was 45.74%.

Chart 9: Distribution of Maximum Yield Probability



RESULTS

3 Key Messages

The following statements can be derived from the results of our investigation:

- ⦿ For certificates with a Maximum Yield Probability of over 50% - this was the case for 43.68% of the certificates - the average yield to be achieved was 6.86% p.a.
- ⦿ For certificates with a Maximum Yield Probability of less than 50% - i.e. 56.32% of the certificates - the average yield to be achieved was 19.76% p.a.
- ⦿ 98.65% of the certificates maturing in 2019, which had a maximum yield probability of at least 80% on the first observation day, achieved their maximum yield.
- ⦿ For certificates with a positive distance to the cap on the first observation day - i.e. the underlying price was below the cap - the average yield was 22.76% p.a. This applied to 43.30% of all discount certificates under review.
- ⦿ 56.70% of the certificates had a negative distance to the cap on the first observation day; here the number of certificates with a positive yield on the last observation day was 89.17%; the average yield achieved here was 7.53% p.a.
- ⦿ For certificates with a relative discount of at least 10%, the average yield was 8.26% p.a. This was the case for 59.01% of the certificates.
- ⦿ With a relative discount of less than 10% on the first observation day - this applied to 40.99% of the certificates - the average yield was 22.57% p.a.
- ⦿ With an implied volatility of at least 30%, the average yield was 18.49% p.a. This was the case for 25.27% of the certificates.
- ⦿ For 92.53% of the certificates under review, of which the price of the underlying asset was above the cap on the first observation day, i.e. those with a negative distance to the cap, the underlying price was also above the cap on the last observation day.

6 DESCRIPTION OF THE MARKET LICENCE & IMPORTANT INFORMATION

DESCRIPTION OF THE MARKET

In Germany, the volume invested in structured products amounted to around 71.3 billion euros at the end of 2019. Discount certificates accounted for approximately 5.8% of this total. (Source: DDV)

At the Stuttgart and Frankfurt stock exchanges, the volume traded in investment products amounted to 16.220 billion euros in 2019. Discount certificates accounted for 6.649 billion euros of this total. This corresponds to a share of almost 41%.

A total of 506,337 investment products were listed in Stuttgart as of 31 December 2019, 185,046 of which 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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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 prospectus and any supplements thereto, as well as in the respective Final Terms.

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

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

TTMzero

TTMzero is a technology company from Berlin-Brandenburg, which offers products and solutions in the area of RegTech and Capital Markets Tech for the financial sector.

The company's expertise lies in the independent evaluation of financial instruments and the calculation of risk indicators. In addition, the product range includes a variety of real-time data products such as key figures for structured products and Software-as-a-Service (SaaS) solutions that support financial institutions in the automation of pre- and post-trade processes.

The Stuttgart Stock Exchange (Börse Stuttgart)

The Stuttgart Stock Exchange (Börse Stuttgart) is the private investor exchange and the leading floor trading place in Germany. Private investors can trade shares, securitized derivatives, bonds, ETFs, funds and participation certificates in Stuttgart.

Stuttgart is the market leader in Germany for exchange trading in corporate bonds and the European market leader in securitized derivatives. In the hybrid market model of the 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. With a trading volume of around 69 billion euros in all asset classes in 2019, the Stuttgart Stock Exchange ranks tenth in Europe.

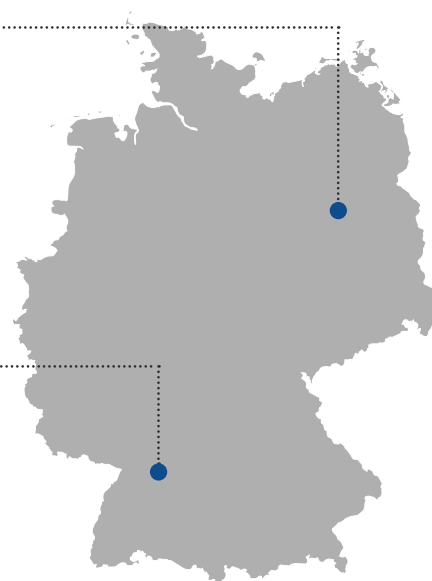
YOUR WAY TO US

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