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absorbing barrier

A parameter used in bonus and in reverse bonus certificates, also called the "security level". Like the bonus level, it is set at issue time and remains unchanged for the entire term of the certificate. The absorbing barrier plays a key role in the repayment of the certificate. Even if it is touched or crossed only once during the certificate's term, the character of the certificate changes completely: the bonus return is forfeited and you usually lose more than if you had invested directly in the underlying asset.

AR2-model

Autoregressive model of second order. AR models are linear models for stationary, stochastic processes that are discrete in time. They are used for time series analysis in measurement technology, statistics, and econometrics. The mathematical equation of an AR2 model is given by:

$$\mu_{t+1} = \Phi_1 \cdot \mu_t + \Phi_2 \cdot \mu_{t-1} + \eta_t$$

where μ is the stochastic variable at various times t and η is a noise term.

bear market

A bear market, or depression, is the name of a declining stock market that lasts for several months up to a few years. During that time, the average yield on stock lies below the long-term level. Typically, a bear market arises after the burst of a speculative bubble, or exaggeration of the stock market. Bull and bear markets run parallel to, but with a time shift from, the economic cycles and the interest cycles.

Black-Scholes model

The Black-Scholes model is a mathematical model used to evaluate options. It was first published by Fischer Black and Myron Samuel Scholes in 1973. For the calculation of the fair value of an option, Black and Scholes assumed that the logarithms of the price changes in the underlying asset (e.g., the S&P 500 index would underlie a S&P 500 option) are independent random variables that satisfy a Gaussian or normal distribution.

bonus level

A parameter in bonus and reverse bonus certificates, which - like the absorbing barrier - is fixed at issue time and remains unchanged during the entire lifetime of the certificate. The bonus level determines the repayment amount of the certificate on expiration, if the underlying asset never touches or breaks through the absorbing barrier during the certificate's term. A detailed discussion can be found in the chapters "**design of bonus certificates**" (http://www.sigmadewe.com/fileadmin/user_upload/pdf-Dateien/SigmaDeWe-Risikomanagement_Bonuszertifikate_engl.pdf) and "**design of reverse bonus certificates**" (http://www.sigmadewe.com/fileadmin/user_upload/pdf-Dateien/SigmaDeWe-Risikomanagement_Reverse_Bonuszertifikate_engl.pdf).

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bull market

A bull market, or boom, describes a rising stock market which can last for several years. In this period, the average yield of stock lies above the long-term level. An excessive bull market may lead to speculative bubbles whose bursting initiate a bear market. Bull markets typically last longer than bear markets. For the long term average of the S&P 500 index since 1950, bull markets averaged about two years, bear markets only about one year (private analysis).

buy-and-hold strategy

A long-term investment strategy in which stock is bought and held without responding to market fluctuations. It is based on the assumption that over very long periods of time (10 years and more) stock markets deliver a positive average annual return that usually lies above the risk-free return of fixed deposits or bonds.

cap

The cap of a (discount) certificate denotes the upper limit to which an investor can maximally participate in the positive price increase of the underlying asset.

certificates

In the financial world, especially in German speaking countries, a certificate is a bond that is issued by banks and mostly sold to private investors. From a legal point of view certificates are debt obligations, therefore, in addition to the risk of value fluctuations, there is also the risk of the issuer's insolvency. If the issuer becomes insolvent, the invested capital is lost completely, as happened with the bankruptcy of Lehman Brothers Inc. in September 2008. With certificates, private persons can also invest in items that are difficult to access, like raw materials, or they can simulate more complex portfolio strategies. There exists a zoo of certificates: index certificates and tracker certificates (in the US known as ETNs or Exchange Traded Notes), ETCs or Exchange Traded Commodities (certificates on raw materials), and basket certificates. In addition, there are reverse certificates, discount certificates, bonus certificates, capital protection certificates, strategy certificates, leverage certificates, to name just a few which allow the simulation of certain portfolio strategies. Certificates are particularly popular in German speaking countries, while in the USA, Canada, Great Britain and Japan they are not sold (except of ETNs in the US). However, in some cases they can be simulated by accredited investments, like the combination of a call option and its underlying asset.

compound interest

Compound interest is interest paid on the sum of the original investment and the accumulated interest. For an initial investment, K_0, that yields interest over N years with the same return, R, each year, the investment after N years is given by: $K_N = K_0 (1+ R)^N$. Thus, the total return, R_N, after N years is: $R_N = (K_N - K_0)/ K_0 = (1+R)^N - 1$.

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Credit Default Swap

Credit Default Swaps (in short CDS) are financial products used to trade credit risks. If the market evaluates the credit-worthiness, or solvency, of a debtor as very good, the CDS that protects the credit is low in price (i.e., the insurance premium is low) because the market considers a loss as improbable. CDS are very responsive to market changes and the related change of solvency of a company. The price of the insurance premium is expressed by the CDS spread in basis points: the lower the rating of a bond on the capital market, the higher is the CDS spread.

credit rating

In general, credit rating is the ability to meet financial obligations. For issuers of bonds, the credit rating is the ability to repay the issue including the interest. Rating agencies like Moody's, Standard & Poor's, and Fitch also give credit ratings for banks and investment houses. In addition, an investor can make use of credit spreads to estimate the credit worthiness of banks (see also credit default swaps).

DAX

"Deutscher Aktienindex", or German stock index. The DAX is the leading index for the German stock market and is made up of the 30 largest German companies with the biggest trade volume. Both market prices and dividends are factored into the DAX, so it is a performance index.

deep discount certificate

A discount certificate with a purchasing price lower than the price of the underlying asset. Since this effectively reduces the risk of loss, the maximally achievable return is accordingly smaller.

discount certificate

Discount certificates are financial instruments listed on the stock exchange that offer the bond holder a discount on the price of the underlying asset, while at the same time limiting the potential increase of the asset to the cap.

econometrics

Econometrics combines economic theory with statistics and mathematical methods to analyze and test economic relationships. Applied to stock market analysis, the econometric method attempts to model the stock market mathematically in order to forecast its future direction. There are different types of models: in time series analysis, the past behavior of a time-dependent variable is examined in order to infer something about its future behavior; in other models, the (dynamic) behavior of one variable is also explained by one or more functions of other variables (e.g. in a model of interest rates, the current interest rate depends on the money supply, the rate of inflation, and the rate of change in the gross national product, in addition to the past interest data). The models we are using here are primarily analyses of time series.

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ETF

Exchange traded fund. It usually simulates a stock index, like the DAX, S&P 500, or a sector index. As it is not actively managed, the management fees as well as the asset-based fees are very low in comparison to actively managed funds. An ETF has the status of separate assets, i.e., in case of insolvency the bank, as well as its creditors, cannot access the fund. The three largest ETF platforms are iShares of BlackRock (formerly Barclay Global Investors), Lyxor of the French Societe Generale Group, and db x-trackers of the German Deutsche Bank.

EURO STOXX 50

The Dow Jones EURO STOXX 50 is a stock index that includes the 50 largest companies of the Euro-zone. It is issued by the American publisher Dow Jones which also publishes the Wall Street Journal. The composition of the index is checked and adjusted annually.

exponential moving average

Abbreviated as EMA. A time series analysis method for forecasting purposes. In this method, it is assumed that the current time series value is influenced by its predecessors, and that recent values have a stronger influence on the current value than those further in the past. The mathematical model for the EMA is given by: $y_t^* = \alpha\, y_t + (1-\alpha)\, y_{t-1}^*$, where y_t is the observed value at time t, y_t^* is the forecast value at time t, and α is a smoothing factor between 0 and 1.

fundamental stock analysis

Fundamental stock analysis considers the financial and business situation of a company together with its economic environment (competitive situation, sector industry data). Based on this analysis, the intrinsic value of a stock is determined. The fundamental data of a company include earnings, cash flow, cost structure, profitability, and future prospects. By comparing the intrinsic value of a company with its stock price, it is possible to determine whether the stock is over- or under-rated. From this, the analyst can give recommendations as to which markets, sectors or stock one should invest in or withdraw from.

Hang Seng

Leading stock market index in Hong Kong, China, made up of 42 companies (status: January 30, 2009) which represent about 70% of the total market capitalization of the Hong Kong stock market. The Hang Seng index is, like the S&P 500 index, a price index, in contrast to the German DAX.

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index certificate

An index certificate's underlying asset is a stock market index, a bond index, or a raw material index. Investors can participate in the index without buying the underlying stocks, bonds, or raw materials. In addition, because of the broad mixture of the index, the risk is lower compared to holding non-diversified stocks. Generally there exist two types of index certificates: those which represent a performance index like the DAX, where dividend payments are included, and those which represent a price index without including dividend payments. In some cases this difference can result in different annual rates of return of several per cent. For indices that are not listed in the local currency there is an additional currency risk. This can be eliminated with so-called "Quanto" index certificates. Index certificates are obligations and are therefore subject to the risk of the issuer's insolvency, in contrast to ETFs.

issuer

The issuer of paper can be a state, a company, a bank or another institution. Issuers of paper need money to settle ongoing liabilities or to finance projects. The paper can be stocks, obligations, certificates, checks and even postage stamps.

Kalman filter

The Kalman filter is a recursive filter (in the form of mathematical equations) that allows the underlying exact state of a dynamic system to be determined from a series of noisy measured values. Besides typical engineering problems, such as the evaluation of radar signals for position tracking or satellite navigation systems, the Kalman filter also can be used in econometric applications like modeling stock markets. With a Kalman filter it is possible to filter out measurement noise and deduce the underlying process by estimating the system status at time t as a linear combination of the preceding estimation and the new measured value z_t .

loss probability

The probability that at the end of the investment period the investment will be less than at the beginning.

In contrast to the concept "Value at Risk" (VaR) that banks usually use and leaves out the worst x[%] of all results, we include all possible negative returns. In our use of "loss probability", P_L, we set VaR=0, because we integrate the return distribution function from -100% to 0:

$P_L = \int_{-100\%}^{VaR(x)=0} p(r)\, dr = x$, where r is the return in % and p(r) is the probability to achieve return r.

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mode

The maximum of a distribution function. A probability distribution is characterized by several parameters (also called moments). The most important ones are the expectation value (or mean value) and the standard deviation (which measures the statistical spread about the mean). A Normal distribution (or Gaussian distribution) is given entirely by these two parameters. For distribution functions that are not symmetric about the mean value, there are two additional location parameters: the mode and the median. The mode of a distribution is the value with the highest probability of occurrence. The median cuts the distribution in two halves. For a Normal distribution, the mean value is equal to the mode and also to the median.

moments of a distribution

The parameters that characterize distribution functions, $f(x_i)$, such as the Gaussian or Normal distribution. The 1st moment is called the expected value and corresponds to the arithmetic mean of the distribution. The 2nd moment is called the variance and characterizes the spread of the distribution. In general, the kth moment of the random variable X is given by $E(X–EX)^k$ with $E(X^k) = \sum x_i^k f(x_i)$.

most probable return

For any investment other than risk-free assets (like savings accounts, fixed deposit accounts, or AAA state bonds) any estimates of future return are uncertain. Therefore the return should be seen as a random variable with a probability distribution. The most probable return is the return where the probability distribution has its maximum (the mode).

Nikkei

The Nikkei 225 index, often called just the Nikkei index, is one of the most important stock indices in Asia. Calculated daily by Nihon Keizai Shimbun newspaper (the Japan Economic Times), it is made up of 225 selected companies which are listed on the Tokyo stock exchange. The Nikkei index is, like the S&P 500 and the Hang Seng indices, a price index, in contrast to the German DAX.

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obligation

Obligations are usually long-term and are usually fixed-interest paper that is issued by private industry or the state to finance credits. Examples of obligations issued by private industry are corporate bonds, debentures, and bank bonds. Obligations issued by states are government bonds. Synonyms are loans, bonds, treasury bills, debentures. In return for lending money, the buyer of an obligation receives a fixed interest. At the end of the term, the contractual obligation ends by paying back (redeeming) the face amount of the bond. Obligations are subject to the risk of the issuer's insolvency; i.e., the debtor (issuer) can default and be unable to pay.

performance index

In contrast to a price index, a performance index includes dividend payments made by the index companies. The German DAX is a performance index. Most of the large world indices, like the S&P 500 or the Hang Seng index, are pure price indices. For better comparison, the DAX is also calculated as a price index (DAXK). The performance index of the S&P 500 is called S&P 500 Total Return index.

random walk

A discrete stochastic process in which each individual random variable is equal to the previous random variable, plus a random change: $\mu_t = \mu_{t-1} + \varepsilon$. When applied to the stock market, the random walk model does not allow successive price changes to be predicted.

rating

Rating agencies assess the credit-worthiness of issuers (states, companies, banks, etc.) according to the probability that they are able to meet their interest and redemption payments. By this criterion, the issuers are divided in classes of credit-worthiness that range from the best grade AAA (highest credit worthiness) to the lowest possible grade D (deficit in payment). In addition to issuers, rating agencies also valuate products like stocks, investment funds and bonds. For interest-bearing securities the amount of interest paid depends on the evaluation of the rating agencies. A poor rating means higher interest yield and vice versa. The best-known rating agencies are Standard & Poor's, Moody's, and Fitch. Unfortunately for private investors, rating agencies gambled their own credibility in the Lehman Brothers insolvency.

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reflection point

A parameter of reverse bonus certificates. Depending on the issuer, the reflection point S is also called the "strike", "base price", "reference level" or "starting price". Some issuers specify only the parameter 2·S, which they call the "reverse price" and is just the maximum possible final price of the reverse bonus certificate. In the design diagram of a reverse bonus certificate the reflection point is defined to be the point at which reflection of a bonus certificate about a vertical line through S results in the corresponding reverse bonus certificate.

risk

Risk is the product of the probability of a negative event times its cost. As an example, consider a bet: you may gain an amount G with probability p_G and you may lose an amount L with probability $p_L=1-p_G$. The risk R to lose L is given by: $R = p_L \cdot L$.

risk-free

The use of the word risk-free here refers only to the lack of volatility, not to the lack of risk of default or bankruptcy. For example, risk-free investments are savings accounts, term deposits, or AAA state bonds which "guarantee" a fixed return.

S&P 500

The S&P 500 index (Standard & Poor's 500) is a stock index that covers the 500 largest US companies listed on the stock exchange. The weighting of the companies depends on their market capitalization. The rating agency Standard & Poor's decides which companies to include in the index. The S&P 500 index is considered an indicator for the changes of the total US stock market and is the more modern index when compared with the Dow Jones Industrial Average index. It represents about 75% of the US stock market capitalization and is one of the most highly observed stock market indices of the world. The classic S&P 500 index is a price index, while the S&P 500 Total Return Index is the associated performance index.

Sharpe ratio

A characteristic number, S, that measures the excess return of an investment per unit risk: $S = (r_A - r_F) / \sigma_A$, where r_A is an investment return that exceeds the risk-free return r_F . In an example: if the money market yields a risk-free return of 3% and the alternative investment yields a return of 10%, the excess return of the alternative investment would be 7%. The excess return is divided by the risk, which is expressed as the volatility, σ_A, or the spread of the investment's return around its mean. The higher the Sharpe ratio the better is the performance of the investment in relation to the risk taken. If the Sharpe ratio is negative, the return of the alternative investment is less than the risk-free return. It is possible to compare the past performance of various investments using Sharpe ratios, so usually these ratios are annualized.

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SigmaDeWe

An homage to the American mathematician Norbert Wiener (1894-1964) after whom the Wiener process, also known as Brownian motion, is named. A Wiener process, W_t , has a Gaussian distribution of independent increments and is used to describe numerous stochastic processes. For instance, a stock market is described by the stochastic differential equation: $dX_t/X_t = \mu\ dt + \sigma \cdot dW_t$ where dX_t are the price changes, μ is the global trend of the stock market over the time increment dt, and σ is the volatility. The noise term dW_t is the differential of the Wiener process.

spread

In stock exchange trading, the spread is the difference between bid and ask price for an asset. The purchase of an asset is made at the higher ask price (subject to market bid) and the sale is made at the lower bid price (subject to market demand). A high bid-ask spread is an indication for missing liquidity in a market. Certificates based on large market indices usually have a lower spread than those based on specific companies or theme indices. In addition, the spread depends on the issuer. So the spreads of discount certificates on the DAX index vary from 0.02% to 0.09%. For less traded products, like a photovoltaics certificate, the spread can be up to 2%.

subscription ratio

In certificate trading the subscription ratio SR specifies how one unit of a certificate U_C relates to one unit of the underlying asset U_U: $SR = U_C/U_U$. **Example:** An index certificate on the underlying asset, the DAX index at 6000 points, is offered with a subscription ratio of 0.01. Under ideal conditions the price (in Euro) of one unit of the index certificate is 6000[points] × 0.01 = 60[€]. Note that in option trading the term "subscription ratio" is just the inverse of SR.

technical analysis

Technical Analysis is the general term for two methods in financial analysis: chart analysis and market analysis. Often technical analysis is considered the same as chart analysis. **Chart analysis** assumes that all information that is important for an investment is already included in the price (chart). Microeconomic and macroeconomic fundamental data are not considered. Chart analysis is mainly applied by short-term oriented investors, so-called traders. Using a multitude of mostly figurative methods, so-called chart formations, traders try to infer future chart prospects from charts of the past, in order to identify good market entry and exit points. **Market analysis** is a further development of chart analysis which uses additional indicators; besides psychological market indicators, chart indicators, such as moving averages or volatility, are used. Daily stock market volumes and the number of stocks reaching new intra-day highs are also popular indicators.

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time series

A series of observed values which usually are collected at equidistant points in time; for example, the weekly closing prices of the S&P 500 index or the daily observed weather data. Time series analysis is the mathematical-statistical analysis of any value that changes in time in order to predict its future development.

transaction costs

Fees that an investor has to pay for the purchase and sale of commercial paper. The transaction costs for individuals can vary substantially from bank to bank. At online banks the transaction costs are typically between 0.3% and 0.5% of the investment value, at bricks-and-mortar banks these costs may be more than 1% of the investment value. In addition to transaction costs there are additional fees: premiums on capital stock for funds and ETFs and spreads (difference between bid and ask price) for certificates. These fees can be up to 5%. The higher the transaction and additional costs are, the more important an investment strategy that gets by with few transactions becomes.

trend

Mean speed of a time series within a defined time interval. Many time series show systematic upwards and downwards motions that can be described with local linear trends. Knowledge of the trend plays a central role in generating forecasts. In our models for market signals we are using the concept "trend" for the average, μ, of the (natural) logarithms of consecutive market index prices, p:

$\mu = 1/L \sum v_i$ where $v_{i+1} = \ln(p_{i+1}/p_i)$ and i is an element of the observable time series of length L.

underlying asset

The asset value to which a derivative (e.g., an option or a certificate) refers. Underlying assets can include stocks of a specific company, baskets of stock, currencies, commodities, or bonds.

value at risk (VaR)

The maximum potential loss of an investment if the worst x[%] of all results are left out. A typical value for x is 1% or 2.275% (2 times the standard deviation). By means of VaR, it is possible to compare the risk of different assets using one characteristic number. Thus, the risk of portfolios of stock, interest rates, or credits can be described and compared by means of VaR.

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volatility

A synonym for standard deviation. In general, volatility is a measure of the variations of a time series around its mean value. For commercial paper, volatility is the variation of the price of the paper around its mean (the return) within a defined time period, usually one year. By means of the volatility, it is possible to estimate the gain or loss potential of a stock or a certificate. The larger the volatility, the higher is the investment risk. While historical volatility is calculated with prices of the past, implicit volatility is determined by the expected variations in the future. The current market prices of options are the basis for the calculation of the implicit volatility.