Asset Management

Convertible Bonds
Fundamentals Asset Allocation Solvency

This document is aimed exclusively at professional clients and suitable counterparties.
The information presented is not intended for private investors.
Dr. Daniel Niedermayer, the author of this report, is a Senior Portfolio Manager in the Global Convertibles team at Credit Suisse. His work focuses on the quantitative screening process and on ALM modeling for convertible bonds under Solvency II and the Swiss Solvency Test.

The majority of the photographs in this publication were made available to us by the Herzog Foundation. The Herzog Foundation photo collection contains some 300,000 photographs that cast light on the history of photography and industrial society. It is one of the most important collections of historical photographs in the world. The period covered ranges from 1839 up to the first moon landing, with a particular focus on photographs from the 19th century. The collection includes masterpieces by great photographers as well as amateur photos admired by the founders.
Dear Reader

The use of convertible bonds as a form of financing has been known since the mid-19th century. At the time, they were issued mainly by US railroad companies to finance their growth, but today’s market is characterized by global diversification. It has been a long time since small to medium-sized companies in growth markets were the only ones issuing convertible bonds. Issuers range from medium-sized companies to large international corporations in both developed and emerging countries.

As a hybrid form of financing somewhere between equity and borrowing, convertible bonds are not only attractive to the issuing company – investors also stand to benefit from particular characteristics of convertible bonds, which are not tied to a specific market situation or investment strategy. As an additional source of risk diversification, they are also suitable for inclusion in mixed (multi-asset class) portfolios. It is important to note the wide range of convertible bond strategies, ranging from low-risk to more dynamic approaches with higher potential for both risk and return.

But why invest in convertible bonds now? The current uncertainty on the financial markets offers opportunities and risks. Convertible bonds allow investors to benefit from a rising market without running the same risk as an equity investment. Interest rates, which are generally low, present another challenge. Attractive returns from bond markets are difficult to achieve using traditional strategies. The situation for convertible bonds looks rather different. Since they are corporate bonds with an equity option component, they contain an additional source of income compared to corporate bonds. Alongside the attractive potential returns offered by convertible bonds, it is important to understand the risks and opportunities they present.

We are keen to help our investors gain a deeper understanding of convertible bonds, which we regard as an attractive asset class. The aim of this report is to shed more light on convertible bonds, highlighting their special features as an asset class, and using practical examples to illustrate their versatility in mixed portfolios.

Another key topic that will be covered is the supervisory system for the insurance industry, incorporating Solvency II and the Swiss Solvency Test, and its impact on the use of convertible bonds. Under this regime, convertible bonds present themselves as an alternative to equity allocations. Their use can increase the solvency ratio of insurance and reinsurance companies. The sections on Solvency II and the Swiss Solvency Test examine the influence of convertible bonds on the level of capital requirements.

Using our Credit Suisse Global Convertibles product range, we aim to offer our clients the best possible solutions in the global convertibles segment. Winning the Lipper Fund Awards in 2011, 2012, 2013 and 2014 is a gratifying endorsement of our work.

We hope you will find this report informative.

Peter A. Schilling
Director

Daniel Niedermayer
Director
The first convertible bonds were issued by US railroad companies in the 19th century. This form of financing proved attractive alongside traditional equities and bonds in the fierce competition for capital.
Convertible bonds are attractive to both companies and investors. Companies benefit from paying lower-than-average interest on convertible bonds compared with corporate bonds, and investors capitalize on increasing share prices.
Executive Summary

This report is divided into five main sections. Each may be read separately, although starting with the main characteristics of convertible bonds will make the rest easier to follow. A short topic overview, indicated by an 📌, is given at the start of each section.

Introduction to Convertible Bonds
Convertible bonds have been in existence for around 150 years. Today, the market is dominated by US issuers (46%), followed by European issuers (36%). In the last 10 years, a trend toward greater activity by Asian issuers has been evident.

The hybrid nature of convertible bonds has benefits for investors: in falling markets, they are protected by the value of the corporate bond, and in rising markets, they benefit from the equity option. This section describes the basic characteristics of convertible bonds and how they function.

Managing Convertible Bonds
There are at least four reasons why it is preferable to delegate the management of convertible bonds to specialists. First, it avoids the prospectus risks that can arise from a failure to note relevant information in the convertible bond prospectus. Second, the risk/return profile is heterogeneous and needs to be reviewed constantly. Third, global diversification for medium-sized investment amounts is only possible through fund solutions because of the large denominations required. Fourth, call and put dates must be carefully observed and the necessary action taken.

Convertible Bonds and Asset Allocation
Convertible bonds have an excellent track record compared with equities, thanks to their high historical performance and low volatility. In mixed portfolios, they are suitable for increasing portfolio diversification and reducing downside risks.

Solvency II and the Swiss Solvency Test
Under Solvency II and the Swiss Solvency Test (SST), convertible bonds have a risk-reducing effect on capital requirements for insurance companies. Case studies are used to demonstrate that a marked improvement in the solvency capital ratio can be achieved by replacing equities with convertible bonds in insurance/reinsurance company portfolios. This effect is described in the two studies on Solvency II and the SST.

Credit Suisse Global Convertibles
Our investment solutions range from globally diversified funds to individual mandates. We follow a consistent investment process tailored specifically to convertible bonds.
Pierre Petit: monument to industry at the World’s Fair held in Paris, 1867
The Convertible Bond Market – a Historical Overview
Railroad companies were the first issuers of convertible bonds in the 19th century. Today, the convertible bond market is globally diversified and the majority of issuers are medium-sized and large companies. The US market represents the largest proportion of the global universe, at just under 46%, followed by Europe (approximately 36%).

Convertible Bonds in Detail
- This section gives an overview of the key terms used for the valuation of convertible bonds: bond floor, parity, convexity, etc.
- Example – the Adidas convertible bond: interpreting the features of a convertible bond using a concrete example.
- Factors influencing the price of convertible bonds and the risks: Features specific to equities, bonds and options must be taken into account when valuing convertible bonds. Risks such as prospectus risk and currency risk must be given special consideration when investing in convertible bonds.
- The price of a convertible bond is linked to the bond floor and parity. Two examples (convertible bonds issued by Klöckner and Südzucker) illustrate how the bond components provide protection and how it is possible to participate in rising equity markets.
The Convertible Bond Market – a Historical Overview

The market for convertible bonds has reached a record high with a volume of almost USD 500 billion.1 However, this type of financing is by no means a new fad. Its history dates back to the 19th century, when American railroad companies needed capital to finance their business. At the time, the US was a rapidly growing economy, similar to the emerging markets of today. Capital was not easy to obtain, whether through issuing equities or bonds. In the fierce competition for capital, another form of financing proved itself attractive to both companies and investors: the convertible bond. The right to convert bonds into shares meant it was possible to benefit from rising equity prices in the US growth market. If the share price failed to rise, investors still had the interest and the repayment of their investment.

For a long time, the convertible bond market was regarded as a market for small to medium-sized companies. This perception changed in the 1980s, when IBM, which then still had a triple A credit rating, financed a company takeover using a USD 1.25 billion convertible bond issue, thus benefiting from lower interest payments compared with corporate bonds. Today, many large cap companies issue convertible bonds. The UBS Global Convertible Index, which covers around half the total market, includes 50% of large cap companies.

Even though the convertible bond market has now been in existence for over a century, it is only in the past 20 years that global issue volumes have soared. In terms of regional distribution, the US has the biggest market share at 40 to 50%. Since the 1990s, Japan – which used to be the biggest issuer after the US – has been overtaken by Europe and then by the rapidly growing other Asian countries. The Asian share of the liquid universe has more than doubled in 10 years (rising from 5 to 10%), whereas Japanese and European convertible bonds have lost market share.

At the end of 2013, the global convertible bond market contained around 2000 bonds with a total value of almost USD 500 billion. However, not all of these bonds are liquid enough or have a sufficient volume to attract a sizeable investor community. Index providers use various criteria to filter the universe by liquidity (see Appendix 5 on page 48 on convertible bond benchmarks). The following analysis of the liquid convertible bond market is based on the composition of the UBS Global Convertible Index (Fig. 1).

Convertible bonds issued by US companies form the largest share of the liquid universe, at 46%. There is also a noticeable concentration of large cap companies independent of region. US large caps alone make up approximately 27% of the overall market.

Investment-grade issuers (companies with ratings from AAA to BBB) comprise over 50%, the majority of which are based in the US and Europe.

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1 Source: UBS AG

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Fig. 1: Composition of the UBS Global Convertible Index (in %); volume: approximately USD 250 billion (as at December 2013, external and internal rating sources used)
Sources: UBS AG, Credit Suisse AG
Convertible Bonds in Detail

Convertible bonds are hybrid financial instruments. They combine the features of corporate bonds (debt) and shares (equity). Like conventional bonds, convertible bonds have a fixed term, at the end of which the investor is entitled to repayment. The difference is that convertible bonds have a conversion right. The investor is entitled to convert the bonds into a predefined number of shares, subject to the conditions set out in the prospectus.

A convertible bond is a corporate bond with the additional option of conversion into shares. It therefore follows that a convertible bond will always cost more than a corporate bond issued by the same company (with the same term and coupon). This lower price barrier is known as the bond floor. It is equivalent to the present value of the future cash flows if the option is not exercised. The percentage difference between the convertible bond price and the bond floor is the investment premium.

In addition to the bond floor, parity is the other natural lower price barrier for a convertible bond. Parity represents the value of the shares into which the bond can be converted. The relative price difference between the bond and parity is called the conversion premium. These relationships are illustrated in Fig. 2.

In the balanced section, the convertible bond is at-the-money. This section is particularly interesting to investors because it provides high participation when the share price is rising and low participation when the share price is falling. It is here that the ratio of upside potential to downside protection is at its highest, and this is where the asymmetric risk/return profile characteristic of convertible bonds comes into its own. This feature is known as the convertible bond’s convexity, which is measured in terms of gamma.

If the share price is comparatively low (left-hand section of Fig. 2), the convertible bond is out-of-the-money and behaves in a similar way to a corporate bond. In this territory, changes in the interest rate and the credit risk premium have an important influence on pricing. Two different types should be distinguished in the bond-like category: convertible bonds from companies with solid credit ratings are protected on the downside by the bond floor. In the distressed section (far left), where a comparatively high probability of default exists, the bond floor may collapse.

If the convertible bond is out-of-the-money, it behaves in a similar way to a corporate bond. If it is in-the-money, its equity-like characteristics dominate. However, how does its price behave between these extremes?

This is in fact the most attractive situation, which is sometimes called the “sweet spot”, since convertible bonds that are at-the-money – i.e. close to the strike price – most clearly demonstrate their hybrid character. The convertible bond reacts more sensitively to a rise in the share price than to an equivalent drop in the share price. In this territory, the payoff is particularly asymmetric and can be attractive from the investor’s perspective. This effect stems from the fact that the bond’s sensitivity to the share price (known as the delta) is itself dependent on the share price. It increases when the share price rises and decreases when the share price falls – a characteristic that is hardly surprising, given that out-of-the-money convertible bonds have a low delta and in-the-money convertible bonds a high delta. The change in sensitivity to the share price is shown by the positive curvature – or convexity – of the curve in Fig. 2. Convexity is measured in terms of gamma, which expresses the absolute change in the delta (%) when the share price changes by 1%.

Convertible bonds can be divided into three categories depending on how the price of the underlying share develops: equity-like, balanced and bond-like.

When the share price exceeds the strike price, the convertible bond is in-the-money. This is illustrated in the right-hand section of Fig. 2, where the value of the convertible bond is close to parity (low conversion premium) and it behaves in a similar way to the underlying share.
The diagram below shows the distribution of gammas for convertible bonds included in the UBS Global Convertible Index (as at the end of 2013). Of the 393 values calculated, around half were above 0.5. This means that the delta (%) of approximately 200 securities increases by more than 0.5 percentage points if the corresponding share price rises by 1%. Fig. 3 shows that approximately 5% of the bonds have a gamma greater than 2.

**Example: Adidas 0 1/4 2019**

The convertible bond from German sporting goods manufacturer Adidas is used as a practical illustration.

Fig. 4 shows the main attributes of Adidas 0 1/4 2019 convertible bond, as they might appear on Bloomberg (‘DES’ function), for example. Some of this information requires further explanation. Parity refers to the value of the underlying shares as a percentage of the nominal value. This percentage value can be calculated by multiplying the conversion ratio by the current Adidas share price and then dividing by the nominal value (109.95 = 91.37 x 2406.7817 / 200,000 x 100). This gives the premium, defined as the percentage difference between the convertible bond price and the parity (17.92 = [129.66 / 109.95 – 1] x 100). Another key figure is the conversion price. This is determined when the convertible bond is issued by dividing the nominal value by the conversion rate (83.099 = 200,000 / 2406.78). If the share price is over EUR 83.099 when the convertible bond matures, the conversion into shares will be worthwhile. If this price is not reached, it is preferable for the investor to choose a repayment of the nominal value of EUR 200,000.

In addition to the structure of the convertible bond described above, other aspects such as call and put procedures must be taken into account. As explained on page 19, a premature call or a missed put deadline may lead to considerable losses. As such, it is essential to know exactly when these deadlines are and to take action in good time. The Adidas 0 1/4 2019 convertible bond contains an embedded soft call option.

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**Fig. 4: Specifications of the Adidas 0 1/4 2019 convertible bond (as at 27.12.2013). Sources: Bloomberg, Credit Suisse AG. As at 23.12.2013**

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**Name of convertible bond**: ADSGR 0 1/4 06/19

**Issuer information**

| Name          | Adidas AG | In the case of exchangeable bonds, the share will be in a different company name to the issuer |

**Convertible information**

- **ISIN**: DE000A1ML0C9
- **Price**: 129.16/129.66 (Bid and ask prices as a percentage of the nominal value; in some cases, unit prices are also possible (e.g. French convertible bonds))
- **Yield to maturity**: -4.367/-4.435 (Yield to maturity in percent; the first value is calculated using the bid price, and the second using the ask price; negative values may occur owing to the option component)
- **Currency**: EUR (Currency in which the bond was issued; may differ from the currency of the share)
- **Country**: DE (Domicile of the issuer or the country in which the ISIN is registered)
- **Rank**: Sr Unsecured (In case of bankruptcy, given priority over subordinated)
- **Coupon**: 0.25% (Fixed and zero coupons are the most common)
- **Conversion ratio**: 2406.7817 (Number of shares into which the convertible bond can be converted; defined at time of issue)
- **Stock ticker**: ADS GY (Bloomberg ticker for the underlying share)
- **Parity**: 109.95 (See text)
- **Rating (composite)**: A (Average rating of several agencies (usually Moody’s, S&P, Fitch))
- **Conversion price**: 83.099 (See text)
- **Stock price**: 91.37 (Current Adidas share price)
- **Premium**: 17.92 (See text)
- **Initial premium**: 40 (Stated in percent; the rate by which the conversion price exceeded the share price at the time of issue)
- **Coupon frequency**: Annual (Annual)
- **Maturity**: 6/14/2019
- **Amount issued**: 500,000 (M) EUR (This convertible bond was issued to the amount of EUR 500 million)
- **Amount outstanding**: 500,000 (M) EUR (EUR 500 million is outstanding on the market)
- **Min. piece/increment**: 200,000 (Minimum amount tradable or minimum increment)
- **Par amount**: 200,000 (Nominal value of the convertible bond in EUR)

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**Fig. 3: Distribution of gammas in the global convertible bond universe**

From the perspective of an investor, it is attractive for a convertible bond to have a high gamma. However, this comes at a price, since the daily loss on the fair value of the embedded option is highest when the convertible bond is at-the-money. In a steady market, the daily loss on the option component is greatest when the gamma is high.

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**Introduction to Convertible Bonds 12/52**
Adidas has a EUR 100 call option from 14.07.2017 to 14.06.2019 on its issued convertible bonds, provided the convertible bond value remains at or above EUR 130 on 20 consecutive days. If the company calls the bonds, the investor usually has 30 days to either convert or sell. If the bonds are not converted or sold within this time, investor yield will be only 100% instead of around 130%. For this reason, it is important that investors are aware of the information provided in the prospectus (see page 19).

**Factors Influencing the Price and Risks of a Convertible Bond**

A convertible bond is a corporate bond with an option right to shares. The price of a convertible bond is thus influenced by a number of factors. For example, interest rate sensitivity and sensitivity as regards the company’s credit quality stem from the bond component. In addition to the equity market sensitivity attributable to the option component, there are other factors connected with derivative valuation, including the volatility of the underlying and the fair value of the option.

The price sensitivity of a convertible bond to all of these factors changes over time and in response to market movements. As a convertible bond will behave like a bond or an equity in different situations, the current risks associated with each convertible bond must be considered individually at any given time and then assessed within the context of the portfolio. The most important risk factors for convertible bonds, the key data for quantifying these risk factors (known as “Greeks”) and the general risks associated with this asset class are described below.

**Equity Sensitivity**: The more a convertible bond is in the money, the greater the value of the embedded option. The equity sensitivity of convertible bonds of this kind can be attributed to the comparatively high probability of a conversion. If the option component is out of the money, equity sensitivity is low. Delta, which is expressed in either absolute or relative terms, is used to quantify equity sensitivity. In the above example of the Adidas 0 1/4 2019 convertible bond, the delta is 0.62 in absolute terms or 56.4% when expressed in relative terms (all key data based on Bloomberg as at 31.12.2013). This means that should the Adidas share rise by 1% (e.g. from EUR 91.4 to EUR 92.3), the convertible bond will increase in value by EUR 0.62 (from EUR 129.7 to approximately 130.3). In relative terms, a 1% rise in the share price results in the convertible bond gaining approximately 0.56%.

**Bond-Specific Sensitivities**:Convertible bonds that are a long way out of the money behave like corporate bonds. When valuing future cash flows, interest rate and default risks must be taken into account. Rho is used as a measure of the interest rate sensitivity of the bond component of a convertible bond. The rho of -4.1 for the Adidas 0 1/4 2019 convertible bond means that the price of the convertible bond will fall by 4.1 points should there be a parallel shift upward in the yield curve of 1%. The default risk of a convertible bond is commonly measured in terms of the credit risk premium, and the corresponding price sensitivity to the latter is expressed using omicron.

**Option-Specific Characteristics**: In addition to the factors described above, typical option-specific factors, such as volatility sensitivity and fair value, play a role in the valuation. The value of the call option embedded in a convertible bond rises as the share price becomes more volatile, as this increases the probability that the holder of the convertible bond will exercise the option at maturity. Sensitivity to changes in volatility is greatest for convertible bonds that are at the money. The Adidas convertible bond has a vega – the relevant risk measurement in this case – of 0.92. Should the volatility rise by 1%, the price will increase by this amount. The second option-specific characteristic, time sensitivity, is expressed using theta. In the above example, the theta of the Adidas convertible bond is -0.01. This is the amount by which the price of the convertible bond falls each day, all other factors being equal.

**Liquidity Risk**: Attention must be paid to the bond’s liquidity, in particular in the case of smaller issue volumes. Liquidity bottlenecks can lead to a considerable increase in trading costs owing to higher bid ask spreads, or even to the suspension of the trading of a security. To reduce the risk of a liquidity bottleneck, convertible bond index providers set minimum criteria as regards market capitalization, historical trading volume and pricing quality (see page 38).

**Prospectus Risk**: The individual structure of a convertible bond is described in its prospectus. This includes, for example, provisions governing when the company can call the bond, call protection and possible takeover protection. As such clauses have a considerable impact on pricing, careful attention must be given to the prospectus. It may be of assistance in this regard to contact analysts and brokers (see section on page 18).

**Currency Risk**: Financial securities issued in foreign currencies are exposed to currency risk. This of course also applies to convertible bonds. Convertible bonds may, however, also exhibit special features in this respect. In some cases, convertible bonds are issued in a different currency to that of the underlying share: For example, the Steinhoff 4 1/2 2018 convertible bond is traded in euros and also pays coupons in euros. Upon conversion, however, the investor receives Steinhoff shares traded in South African rand (ZAR). Bonds of this kind need to be assessed separately as regards their currency exposure. It should be noted that figure 6 gives average values for each price category and is for guidance only. When selecting a convertible bond, however, other individual aspects, such as terms to maturity, call and put procedures and seniority, need to be taken into account. These aspects are not included in figure 6.
The sensitivities described above can also be aggregated for the overall market. Fig. 6 shows the main features of convertible bonds in relation to prices in the liquid convertible bond universe. In order to improve comparability, the table does not include mandatory convertibles, perpetuals or convertible bonds quoted in unit prices rather than as a percentage of nominal value.

<table>
<thead>
<tr>
<th>Price</th>
<th>&lt;80</th>
<th>80–100</th>
<th>100–120</th>
<th>&gt;120</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>5</td>
<td>51</td>
<td>103</td>
<td>103</td>
<td>332</td>
</tr>
<tr>
<td>Yield to maturity</td>
<td>25.4%</td>
<td>4.1%</td>
<td>-0.4%</td>
<td>-19.5%</td>
<td>-5.1%</td>
</tr>
<tr>
<td>Delta</td>
<td>4%</td>
<td>24%</td>
<td>37%</td>
<td>84%</td>
<td>49%</td>
</tr>
<tr>
<td>Gamma</td>
<td>0.09</td>
<td>0.32</td>
<td>0.84</td>
<td>0.48</td>
<td>0.66</td>
</tr>
<tr>
<td>Category</td>
<td>Busted</td>
<td>Out-of-the-money</td>
<td>At-the-money</td>
<td>In-the-money</td>
<td></td>
</tr>
<tr>
<td>Comment</td>
<td>High default probability; delta and YTM are high to very high</td>
<td>Bond-like instruments; high YTM depending on credit rating</td>
<td>High convexity; reduced impact if share prices are falling during participation in increasing prices</td>
<td>Similar to equity; high delta, low or negative YTM</td>
<td></td>
</tr>
</tbody>
</table>

Changes in Convertible Bond Prices in Relation to Bond Floor and Parity
It is not only from a theoretical standpoint that bond floor and parity, which are described in the introductory section, are of interest. They can also be observed in relation to movements in the convertible bond price. An examination of the price movements of the Südzucker and Klöckner convertible bonds clearly shows the cushioning effect of the bond floor and the possibility of participation in the share price.
Fig. 8 shows the influence of parity on the price of the convertible bond issued by the Mannheim-based sugar manufacturer Südzucker. By definition, the parity rises in line with the Südzucker share. The increase in parity of around 70% resulted in a significant 46% rise in the convertible bond price between December 2009 and December 2011. It is noteworthy that the equity sensitivity (delta) of the convertible bond increases as the parity rises.

These two examples show the risk-reducing effect of the bond floor and the possibility of upside participation when the parity is rising. Before purchasing a convertible bond, it is always worth examining the gap between the two lower price barriers in order to better estimate the risks and opportunities.
Convertible bonds can be structured in different ways. The details are set out in the prospectus.
Managing Convertible Bonds

Why Delegate?
There are at least four reasons for delegating the management of convertible bonds to specialists:

- **Adherence to the Prospectus**
  The structure of a convertible bond prospectus defines how the bond operates. This can vary greatly from one security to another and may be crucial to the success of the investment.

- **Managing the Risk/Return Profile**
  The risks and potential returns offered by convertible bonds change over time. The composition of the portfolio must take this into account.

- **Large Denominations**
  Some bonds require a high investment volume. Investors can use a fund solution in order to benefit from global diversification even if the investment amount is relatively small.

- **Continuous Portfolio Monitoring**
  Call and put deadlines must be scrupulously observed. Missing them could result in significant losses.

**Investment Strategies Using Convertible Bonds**

- **Long-only strategies** are usually divided according to risk profile and/or region. Mixed strategies, which include other asset classes in addition to convertible bonds, are also possible in long-only strategies.
- **Long/short strategies** such as convertible arbitrage are sometimes used by hedge funds. They hold long positions in convertible bonds and short positions in equities.
Why Delegate?
There are a number of reasons for building a position in convertible bonds by means of a mandate or fund and delegating the management to a specialist asset manager. Investing in individual securities directly instead of using a fund or mandate solution may pay off, too, but the extra cost must not be underestimated. In such a case, it is also important to consider concentration risks from the perspective of risk diversification.

The four major advantages of delegation are described below.

Adherence to the Prospectus
The prospectus contains the specifications of the convertible bond in question. It will also include information on the issuer and the bond’s rank, the conversion ratio, any call and put procedures and other details regarding takeover protection, dilution protection, sleeping investor clauses, etc. All these features may be highly relevant in certain circumstances. As described in more detail below, call and put conditions, for example, may have a significant influence on the pricing of convertible bonds. The table below gives an overview of the most common terms used in the prospectus.

Managing the Risk/Return Profile
Factors such as the trend in the underlying share price and changes in the company’s credit rating affect a convertible bond’s risk features. An assessment must be made in each individual case to decide whether a convertible bond fits the selected risk profile and how it will affect the overall portfolio risk. This applies to purchasing decisions as well as to existing securities in the portfolio.

As Fig. 9 illustrates, there is a broad spread of risk characteristics within the liquid convertible bond universe.

<table>
<thead>
<tr>
<th>Issue/guarantor</th>
<th>A distinction can be drawn between issuer and guarantor. The guarantor is the legal debtor for the convertible bond; the issuer, which issues the bond, may be a subsidiary or the finance division of the company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Guarantor’s rating by Fitch, Moody’s or S&amp;P</td>
</tr>
<tr>
<td>Bond’s rank</td>
<td>Gives the order in which the creditors are repaid if the debtor should become insolvent; creditors holding bonds with the lowest priority are the last to be paid</td>
</tr>
<tr>
<td>Issue volume</td>
<td>The total nominal amount is usually stated at the start of the prospectus in the general terms and conditions</td>
</tr>
<tr>
<td>Conversion right</td>
<td>Specifies the underlying shares and the conversion ratio</td>
</tr>
<tr>
<td>Exercise period</td>
<td>The period during which the investor can convert the bond into shares</td>
</tr>
<tr>
<td>Interest rate, maturity, repayment</td>
<td>Amount and frequency of interest payments, last interest payment, repayment amount</td>
</tr>
<tr>
<td>Currency</td>
<td>The currency in which the interest payments and repayment are made</td>
</tr>
<tr>
<td>Dilution protection</td>
<td>An adjustment to the conversion ratio may be stipulated in the case of capital increases, for example</td>
</tr>
<tr>
<td>Share split</td>
<td>Adjustment to the conversion ratio</td>
</tr>
<tr>
<td>Takeover protection</td>
<td>Adjustment to the conversion rights (in respect of underlying shares and conversion ratio) in the case of a merger</td>
</tr>
<tr>
<td>Negative pledge</td>
<td>In essence, this is an undertaking by the debtor not to pledge its assets as collateral in the future without offering existing creditors the same degree of security</td>
</tr>
<tr>
<td>Call conditions</td>
<td>Information about the conditions under which the debtor can redeem the convertible bond; examples: soft call, hard call, notice period, call price, etc.</td>
</tr>
<tr>
<td>Put conditions</td>
<td>Information about the conditions under which the creditor can return the convertible bond; many different structures similar to those for call conditions are possible</td>
</tr>
<tr>
<td>Denomination/minimum investment</td>
<td>Rules on trading conditions; particularly relevant to retail investors with low to medium investment volumes</td>
</tr>
</tbody>
</table>

Fig. 9: The convertible bond universe in terms of risk (as at 31.12.2013)

The lower area outlined in blue in Fig. 9 contains securities with a historical volatility of below 5% (90-day volatility as at 31.12.2013). About 47% of the universe is found in this area, with low equity sensitivity. Convertible bonds that are out-of-the-money but still have a good credit rating (low yield) belong to this group. Please note that the yield-to-maturity can also be negative for convertible bonds if the bond is trading above par with a sufficiently low coupon. However, this indicator ignores the option component and therefore the possibility of conversion.

The upper area outlined in red in Fig. 9 consists of securities with a volatility of above 10%. These securities — about 53% of the universe — have high equity sensitivity and/or a high yield-to-maturity. 48% of the universe can be found in the upper left-hand area of Fig. 9. The securities in this area feature high equity sensitivity with low yield. This is typical of bonds that are in-the-money.
The high volatility of the 5% of the universe in the right-hand area is typically attributable to the poor credit ratings of the issuers in question. Equity sensitivity can be high or low for securities of this kind. Provided that a positive share price trend reduces the likelihood of the company defaulting, there is a positive relationship between the share price and the convertible bond price.

Another feature of convertible bonds – convexity – also plays an important role in Fig. 9. The higher the convexity of a convertible bond, the faster its equity sensitivity changes in response to the share price trend. If its convexity is high, a security in the lower section of Fig. 9 (low volatility) can quickly move upward when the share price trend is positive. In such a case, the security would achieve an above-average profit in comparison to an equivalent corporate bond.

Similarly, in falling equity markets, high-convexity convertible bonds in the upper left-hand area quickly slip down into the low-volatility zone. This characteristic is one of the most attractive features of convertible bonds, as the risk attached to the convertible bond automatically diminishes when equity markets are falling.

Professional management must also take into account the risk distribution in Fig. 9, together with the breakdown of the portfolio into regions, countries and sectors, for example. Changes in these risks could lead to an undesirable shift in the portfolio risk. This is avoided when convertible bonds are managed professionally.

Large Denominations

Some convertible bonds have very high denominations. The denomination of the Acer 0 2017 convertible bond is USD 100,000, the Adidas 0.25% 2019 is EUR 200,000 and the Siemens 1.65% 2019 is USD 250,000. When building a global exposure in convertible bonds, it is necessary to ensure that the investment volume is high enough to allow the risk to be sufficiently diversified.

Choosing a fund solution in preference to direct investment averts the problem of these sometimes high denominations and makes it possible to achieve a globally diversified investment in convertible bonds even if only low amounts are available.

Continuous Portfolio Monitoring

There is a lot of administrative work involved in managing a convertible bond portfolio. This is partly owing to the numerous kinds of corporate actions. In the context of convertible bonds, corporate actions include: calls, puts, company mergers, share splits, coupons and par value repayments.

Asset managers are not only responsible for making the correct bookings, but also for ensuring exact compliance with call and put deadlines. Missing the relevant deadlines can result in a significant loss. The following two examples demonstrate this.

Early Call

Companies may have the right to redeem a convertible bond on certain fixed conditions. This right usually comes into force after a certain amount of time known as the call protection period. After this date, the company can redeem the convertible bond after a notice period that is typically 30 days. If the call price is less than the value of the underlying share, and if the deadline for a sale or conversion is missed, significant losses could occur on the position.

The example of the convertible bond of the Norwegian oil extraction company Seadrill illustrates the significance of the notice period. On 10.05.2011, Seadrill exercised its right to redeem the bond at the nominal value. Fig. 10 shows the effect on the price of the convertible bond.

Investors who failed to sell or convert their bonds during the 30-day notice period received only 100% of the nominal value instead of 119%. Disregarding the call would have led to a loss of -16%.
Put Rights on the Convertible Bond
While the company may have call rights, the investor may also have put rights in respect of the convertible bond. These allow the investor to return the convertible bond at the put price under certain circumstances. If the convertible bond is returned early (or “put”) by the investor, the maturity term is brought forward to the relevant put date. If the put date for the convertible bond is missed, the maturity term is extended to the next put date or to the maturity date of the bond. This means that the current value of the bond component may fall, and with it the convertible bond price. The convertible bond of Bristol-Myers Squibb, the US pharmaceuticals group, provides a striking example of this (see Fig. 11).

Fig. 11: Losses caused by disregarding the put date for the Bristol-Myers Squibb 2013 convertible bond.

Historical performance indications and financial market scenarios are no reliable indicator for current or future performance.

The BMY Float 09/15/23 convertible bond could be redeemed at 100% on 15.09.2008. After this date, the bond’s value fell from about 98 to 80% of the nominal value. The new value of the new put date of 15.09.2013 reflects the current value of all cash flows due by that date (and the option value). Missing the put would have incurred a corresponding loss on the position.

Investment Strategies Using Convertible Bonds
Convertible bond strategies can be divided into two main groups: Long-only and long/short strategies. Long-only strategies are the traditional form of investment. Please note, however, that this division of the strategies is not always definitive. A mixture of both approaches is also possible.

Long-only strategies
The hybrid character of convertible bonds makes it natural to divide strategies into a number of different risk categories. One way of doing this is to allocate them according to their position on the payoff curve. In-the-money convertibles have the highest equity sensitivity. If the universe is limited to these bonds, it is possible to formulate a dynamic strategy with high equity sensitivity and high volatility.

Focusing on the middle segment places the emphasis on convexity. Many long-only strategies use this filter, since it achieves the typical payoff for convertible bonds. Convertible bonds in this category have the attractive feature of high participation in rising markets, along with low participation in falling markets. Limiting the universe to the convex segment is also known as a focus filter.

Out-of-the-money convertible bonds display bond-specific characteristics. In this segment, special attention must be paid to the credit rating of the company. A bond-like strategy with low volatility can be pursued by focusing on high-quality companies. If the focus is on out-of-the-money convertible bonds with lower credit ratings, this resembles a high yield strategy. The latter two cases show that it makes sense to subdivide by credit rating category as well as to filter by position on the payoff curve. This generally means differentiating between investment grade and sub-investment grade securities.
A differentiation can also be made by region (e.g. US, Europe, Japan, Asia ex Japan, etc.) as well as by risk. For these strategies, it is particularly important to consider the size of the universe and possible liquidity shortages in connection with high volumes. One way of increasing liquidity is to include liquid corporate bonds from the relevant region.

**Mixed strategies** are noted for containing other asset classes in addition to convertible bonds. Although this can increase the portfolio's liquidity in some conditions, it makes a comparison with traditional convertible bond strategies more difficult.

A currency management solution can be defined regardless of the strategy chosen. Much of the volatility can be reduced if the strategy is hedged in the reference currency (Swiss francs for Swiss investors, euros for German investors), since from the Swiss perspective, almost 100% of a global convertible bond portfolio is in foreign currencies (for a euro investor this falls to around 70%). In an unhedged strategy, a significant portion of the portfolio return is driven by currency fluctuations rather than by the convertible bond asset class. Note that a hedge can be applied to restore the currency exposure of the benchmark. If the foreign currency component is too high – which can happen when a foreign currency security is overweighted against the benchmark – it can be hedged using foreign exchange forwards. If currencies are not hedged back to their neutral quotas in the benchmark, this is known as active currency management.

One feature the strategies described above have in common is that they do not make use of short selling. This opportunity is open to hedge funds with long/short strategies. Hedge funds that specialize in convertible arbitrage usually buy convertible bonds while simultaneously short-selling the underlying share. The ratio between the size of the purchase and of the short sale can be chosen in such a way as to virtually eliminate the sensitivity to equity market changes (dynamic delta hedging). That is why this kind of strategy is also known as market-neutral or non-directional. In convertible arbitrage strategies, a potential profit arises from the interplay between convexity and market volatility. Changes in the share price in either direction can result in profits (continuous change in the convertible bond delta according to the share price trend). Losses typically arise in sideways markets or when there is an abrupt change in liquidity and financing costs.

The low correlation with equity markets, along with high returns of nearly 60% – as measured on the HFRX Convertible Arbitrage Index between 31.12.1999 and 31.12.2007 – has certainly contributed to the attractiveness of this strategy. During the 2008 financial crisis, it became evident that this supposedly low correlation can jump markedly in certain market phases. Between 31.12.2007 and 31.12.2009 the HFRX Convertible Arbitrage Index lost nearly 41%, which was significantly more than equities (MSCI World Index) at -22%. According to academic studies, liquidity premiums – compensating investors for the lower liquidity of investments – were one reason behind the high returns. Dwindling liquidity at the end of 2008 illustrated the risks connected with this premium.

Historical performance indications and financial market scenarios are no reliable indicator for current or future performance.
Albert Fernique: gas factory at La Villette (Paris), 1878/1879
As part of the asset allocation, convertible bonds can be a useful instrument. The following sections examine the effect of convertible bonds in mixed profile asset allocation. The following summary statements can be made in this context:

- **Risk and Return of Convertible Bonds**
  - High historical returns compared with shares and a high Sharpe ratio.
  - A shorter duration than government or corporate bonds is an advantage when interest rates rise.
  - Assuming that credit risk premiums tighten, convertible bonds will simultaneously profit from their bond and equity components.

- **Portfolio Optimization with Convertible Bonds**
  - Having convertible bonds as a core portfolio component can provide risk diversification for different levels of risk tolerance.
  - The risk diversification is highest for profiles with medium risk.
  - The extent of risk diversification also depends on the selected convertible bond strategy.

- **Reduction of the Expected Shortfall**
  - The addition of convertible bonds reduces the portfolios’ expected shortfall.
  - This topic can be of particular significance for insurance companies under the Swiss Solvency Test.
  - Convertible bonds reduce the magnitude of negative deviations (tail risk). This effect is particularly pronounced in the case of high convexity.

- **Natural Adjustment of the Risk Profile (Asymmetrical Return Profile)**
  - The equity sensitivity of convertible bonds is reduced in falling markets.
  - If additional risk reduction is desired, there is less need for rebalancing than with equities.
  - Owing to the equity sensitivity, convertible bonds profit from positive markets.
Risk and Return of Convertible Bonds

In terms of historical performance since 1997, the most noticeable factor is the high returns of convertible bonds as measured against the UBS Convertible Global Index.

<table>
<thead>
<tr>
<th>Category</th>
<th>Return p.a.</th>
<th>Volatility</th>
<th>Sharpe ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shares</td>
<td>4.3 %</td>
<td>15.0 %</td>
<td>0.07</td>
</tr>
<tr>
<td>Convertible bonds</td>
<td>7.6%</td>
<td>11.1 %</td>
<td>0.39</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>5.4 %</td>
<td>2.9 %</td>
<td>0.76</td>
</tr>
<tr>
<td>Government bonds</td>
<td>6.0%</td>
<td>4.0 %</td>
<td>0.71</td>
</tr>
</tbody>
</table>


MSCI World (TR) versus UBS Global Convertible Index versus ML Global Broad Corporate versus ML Gl. Sov. Broad

With an annualized return of 7.6%, convertible bonds have clearly surpassed the returns of global equities and government and corporate bonds (the benchmark indexes are hedged in the reference currency US dollars). The two major stock market crashes in this period impacted convertible bonds far less than shares. As convertible bonds exhibit lower volatility than equities (11.1% versus 15%) and higher returns, this results in higher Sharpe ratios.

However, a comparison of the Sharpe ratios also demonstrates that convertible bonds were behind government and corporate bonds from a risk/return perspective. One explanation for this is the falling interest rate environment we have had for decades, as well as the higher average duration of government and corporate bonds. Historical returns of corporate bonds can be divided into an interest component and a credit component. Over the course of the last 10 years, falling interest rates were visibly the main driver of returns on corporate bonds. With interest rates at historically low levels – in many countries nearly at 0% – the trend cannot continue on this scale. An upward adjustment of interest rates would lead to negative performance. With their relatively low average duration of 3.7 versus 5.9 years in the ML Global Broad Market Index, convertible bonds are well-equipped for such instances.

In addition to interest rate trends, the change in credit spreads is another decisive factor for government and corporate bonds. Investors holding corporate bonds, for whom the positive performance of credit quality is a priority, can also consider convertible bonds as an alternative. If credit quality improves, convertible bonds profit from two factors simultaneously: the bond floor and the underlying share (a positive stock market trend is often accompanied by an improvement of credit quality). The effect of these two factors can be seen in Fig. 13 for 2009, a year in which global convertible bonds, with a return of 41%, left global equities far behind (31%). This shows that credit risk premium tightening is a significant driver of return in practice as well as theory.

Portfolio Optimization with Convertible Bonds

The addition of convertible bonds to a mixed portfolio can reduce the portfolio risk without changing the return expectations. To illustrate this effect, the following chart shows a risk/return simulation for a mixed global portfolio (consisting of government bonds, corporate bonds, high-yield bonds and global equities) to which global convertible bonds are added.

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2 Another reason for the fall in prices and subsequent recovery was the deleveraging of convertible arbitrage hedge funds.
3 For details on this simulation, see Appendix 1.

Historical performance indications and financial market scenarios are no reliable indicator for current or future performance.
As Fig. 14 shows, the risk of a portfolio is reduced with the addition of convertible bonds, or the expected return is increased without increasing the risk. This effect of risk diversification is significantly influenced by the low correlation of global convertible bonds with global government and corporate bonds (-0.3 and +0.05, respectively). In addition, the portfolio risk is reduced as a consequence of the lower volatility of global convertible bonds in comparison to shares.

Two interesting conclusions can be drawn from this analysis. First, the effect of risk diversification is highest for portfolios in the medium risk range. If convertible bonds are added to a mixed global portfolio with a return expectation of 4 to 6%, the volatility of the portfolio can be reduced to about 0.8%. The second conclusion is that the positive effect of convertible bonds is independent of the risk profile of a portfolio. This is illustrated in Fig. 15. For each optimally mixed portfolio (with convertible bonds), the composition is determined and shown in dependence on the portfolio risk. It is worth noting that the risk/return-optimized portfolios have a core component of convertible bonds of approximately 10%, depending on the risk profile. This demonstrates that the addition of convertible bonds can even be worthwhile in portfolios with low risk tolerance. As shown in Fig. 15, a balanced profile with 8% volatility would contain 9% government bonds, 31% corporate bonds, 19% high-yield bonds, 27% shares and 14% convertible bonds.

To understand this analysis, it is important to recognize that various parameters can influence optimization. The indices and input factors used for this analysis are shown in Appendix 1. Moreover, attention should be paid to the selection of convertible bonds during implementation, as they can also have different risk profiles. The UBS Convertible Global Index hedged in Swiss francs was used for this simulation. In using a convertible bond index with lower equity sensitivity, optimized portfolios with low risk tolerance would have a higher proportion of convertible bonds than in Fig. 15. In this example, all indices were hedged against the Swiss franc. However, the conclusions remain unchanged from a qualitative perspective if the simulation is presented without currency hedging.

**Reduction of the Expected Shortfall**

In addition to the “traditional” risk measure of volatility, increasing attention is also being paid to the expected shortfall of a portfolio, given that it is better suited for quantifying the probability of extreme (negative) portfolio returns. As such financial market data tends to occur more commonly as positive extreme events (also more frequently than for a normal distribution of returns), the probability of negative extreme events is underestimated and that of positive events is overestimated owing to the symmetry of the volatility measure. To accommodate this factor, the expected shortfall is regarded as a risk measure, including, for instance, in the Swiss Solvency Test for Swiss insurance companies. This represents the average loss of the worst x% of all observed portfolio returns, where a figure such as 1 can be taken for x.

The expected shortfall is particularly relevant in the context of convertible bonds because they do not exhibit a symmetrical return profile and are able to absorb negative equity market shocks. This is a consequence of equity sensitivity (delta) and the change in the equity sensitivity (gamma) of convertible bonds. If convertible bonds are added to a mixed portfolio, the likelihood of extreme negative portfolio returns is reduced. This characteristic of convertible bonds in the context of a mixed portfolio is shown in Fig. 16.
In the analysis underlying Fig. 16, a portfolio consisting of 50% global government bonds (JPM GBI Global Hedged CHF), 25% global corporate bonds (BarCap Global AggCorporate Hedged CHF) and 25% global equities (MSCI World Hedged CHF) is observed on a weekly basis from 01.01.2001 to 31.12.2013. The expected shortfall of this portfolio is -2.2% — this means the average of the worst 1% of all weekly returns in the period resulted in this loss. If some shares are replaced with global convertible bonds (hedged in Swiss francs), the expected shortfall risk of the entire portfolio is reduced. For instance, if a 10% component of convertible bonds representing the UBS Convertible Global Index is added to a portfolio so that it consists of 50% government bonds, 25% corporate bonds, 15% shares and 10% convertible bonds, the expected shortfall is approximately 1.8%. If convertible bonds with a higher convexity such as the UBS Convertible Global Focus Index are used as an alternative to shares, the expected shortfall of a mixed portfolio can be further reduced to just 1.8%.

If the historical returns of the underlying portfolios in Fig. 16 are taken into consideration alongside the expected shortfall, the outcome remains a favorable assessment of global convertible bonds. If global equities were replaced with the UBS Convertible Global Index, the annual return on the portfolio would have in fact increased in the course of this period. The cumulative return of a CHF portfolio without convertible bonds would be 54.4% in this period. With 10% convertible bonds (UBS Convertibles Global Index) instead of shares, it would be 60.1%; with 25% convertible bonds (UBS Convertible Global Focus Index) instead of shares, it would be 68.2%.

Choosing the Right Convertible Bond Strategy
Convertible bonds have various risk and return characteristics. This should be taken into consideration when making an investment decision. It is therefore worthwhile to classify convertible bonds into various groups based on their main characteristics. One important characteristic is the credit quality of the underlying company, since repayment of the bond depends directly on the company. A distinction can be made here between investment-grade and non-investment-grade companies. Another important characteristic of convertible bonds is convexity. Convertible bonds with high convexity have the advantage of being able to react quickly to positive equity markets and suffer less when markets fall. The focus on convex bonds has a risk-reducing effect. Additionally, the convex profile is what investors are looking for when they invest in convertible bonds.

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Fig. 16: Reduction of the expected shortfall through convertible bonds (weekly basis)

Sources: Bloomberg, Credit Suisse AG; as at 31.12.2013

Historical performance indications and financial market scenarios are no reliable indicator for current or future performance.

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4 The portfolio weightings are rebalanced annually.
By selectively applying these two types of filters to the liquid global convertible bond universe, four indices can be constructed. Their respective risks are summarized in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Volatility (in%)</th>
<th>Expected shortfall (weekly, in%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UBS Convertible Global Hedged CHF</td>
<td>9.2</td>
<td>-5.8</td>
</tr>
<tr>
<td>UBS Convertible Global Focus Hedged CHF</td>
<td>8.3</td>
<td>-4.9</td>
</tr>
<tr>
<td>UBS Convertible Investment Grade Hedged CHF</td>
<td>8.2</td>
<td>-5.0</td>
</tr>
<tr>
<td>UBS Convertible Focus Investment Grade Hedged CHF</td>
<td>7.4</td>
<td>-4.8</td>
</tr>
<tr>
<td>Shares</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSCI World Hedged CHF</td>
<td>15.0</td>
<td>-10.4</td>
</tr>
<tr>
<td>Government bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JPM GBI Global Hedged CHF</td>
<td>3.1</td>
<td>-1.3</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BarCap Global Agg Corporate Hedged CHF</td>
<td>4.0</td>
<td>-2.1</td>
</tr>
</tbody>
</table>

Fig. 17: Risks of convertible bond indices in comparison to shares and bonds ("Focus" refers to the concentration on convex bonds)

Sources: Bloomberg, Credit Suisse AG; as at 31.12.2013

The risk metrics in Fig. 17 refer to the period from 01.01.2001 to 31.12.2013, in the reference currency Swiss francs. To show the differences in risks independent of the currency effect, indices with currency hedging were used. Fig. 17 shows that there are certain differences between many convertible bonds, as well as between shares and bonds.

If no complete currency hedging is undertaken, attention should be paid to the distribution of currencies within the convertible bonds indices. The volatility and the expected shortfall can be significantly increased as a consequence of currency risks. If such risks are consciously controlled with a currency overlay in the context of asset allocation, the chart in Fig. 18 is relevant for a determination of the amount of currency hedging.

<table>
<thead>
<tr>
<th>USD</th>
<th>EUR</th>
<th>JPY</th>
<th>CHF</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBS Convertible Global</td>
<td>61.5</td>
<td>26.7</td>
<td>5.0</td>
<td>1.0</td>
</tr>
<tr>
<td>UBS Convertible Global Focus</td>
<td>59.6</td>
<td>29.1</td>
<td>5.4</td>
<td>0.5</td>
</tr>
<tr>
<td>UBS Convertible Investment Grade</td>
<td>67.0</td>
<td>25.3</td>
<td>4.0</td>
<td>1.1</td>
</tr>
<tr>
<td>UBS Convertible Focus Investment Grade</td>
<td>60.6</td>
<td>22.8</td>
<td>3.0</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Fig. 18: Currency distribution of UBS convertible bond indices (as at 31.12.2013)

Source: UBS AG
Adolph Braun & Cie.: construction of the Gotthardbahn railway, upper section in the Biaschina Gorge, around 1880
Solvency II – an Overview
The new solvency capital requirements for insurance companies have far-reaching consequences. Even though some changes are to be expected prior to full implementation in 2016, measures to adjust asset allocations and insurance payouts already have to be reviewed today.

Convertible Bonds under Solvency II
The results of the fifth Quantitative Impact Study allow for the modeling of a typical European life insurance company. Based on this example, the influence of an increase in convertible bonds to the solvency ratio (SCR coverage) can be calculated. For each percent of additional convertible bonds in place of shares, the SCR coverage increases by up to 5%. The study shows that in addition to the SCR coverage, the Sharpe ratio can also be increased by convertible bonds in various realistic scenarios.

The Swiss Solvency Test (SST)
Supervision of Insurance Companies in Switzerland
Credit Suisse has developed SST software for the analysis of target capital with various allocations. The influence of convertible bonds is similar to the European case. A realistic example is used to demonstrate that a (major) insurance company can increase its solvency capital ratio by up to 5% by increasing the convertible bond allocation by CHF 1 billion.
European insurance regulators are about to introduce a number of far-reaching reforms. In connection with Solvency II, the new regulations concerning risk-based capital adequacy for European insurance and reinsurance companies are expected to be implemented by January 2016. This body of legislation not only has far-reaching consequences for the insurance industry, but shifts are also expected in the allocations on the assets side of corporate balance sheets.

Expected risks and returns of financial assets in the portfolios of insurance companies also have to be evaluated with respect to the costs associated with raising additional capital requirement. In this context, it turns out that convertible bonds, with their convex payoff in comparison to shares, are suitable instruments for reducing the insolvency risk in accordance with Solvency II. Aside from providing an overview of the new supervisory regime, the following sections analyze the effect of convertible bonds on the amount of capital adequacy under Solvency II and in the SST.

### Solvency II – an Overview

Adopted by the European Union in 2009, Solvency II is scheduled to be transposed into national law by early 2015. European insurance companies were given a transitional period of one year to fulfill the requirements. Important objectives of this directive include improving protection for policyholders and increasing financial market stability. It also promotes the integration of the European insurance market. The “EU passport” for European insurance companies recognizes authorizations and supervisory systems throughout Europe and promotes competition within the European Union.

The current supervision of insurance companies is based on standards that were established in part in the 1970s and are now considered outdated. While Solvency I leaves a lot of leeway for national regulation and places the primary focus on risks on the liabilities side, Solvency II seeks an integrated analysis of risks in the balance sheet. In the latter framework, market values are relied upon rather than accounting values. Under Solvency II, insurance companies can use a predefined standard model or an internal model to determine the required capital; internal models require approval from the financial authorities.

Solvency II has a three-pillar structure, similar to that of Basel II – the reform package for banks. Pillar 1 contains quantitative requirements. It defines calculation methods for determining the amount of capital adequacy (Solvency Capital Requirement, SCR, and Minimum Capital Requirement, MCR) as well as the risk assessment of asset and liability items in the balance sheet. These specifications are based on value-at-risk measurement, according to which the likelihood of bankruptcy within one year is to be reduced to under 0.5%. Pillar 2 contains qualitative requirements for insurance companies and supervisory authorities. These include the introduction of the own risk and solvency assessment, and the supervisory review process. Pillar 3 encompasses transparency aspects, such as harmonized reporting and reports on the solvency (SCR, MCR) and financial situation of companies.

![Fig. 19: The Three-Pillar Structure of Solvency II](image)

**Sources:** Bennemann, Dehemberg, Stahl (2011)

### Capital Adequacy under Solvency II

The capital adequacy requirements specified in the quantitative requirements of Pillar 1 are described in the document entitled “QIss Technical Specifications” and dated 05.07.2010.² The document also defines evaluation principles for assets and liabilities, the calculation of the Minimum Capital Requirement (MCR), and the eligibility of own funds.

Pursuant to the Solvency II Directive (Directive 2009/138/EC), the evaluation has to be carried out in accordance with economical, market-consistent methods. Assets have to be evaluated according to their market value, and liabilities at the value that a third party would charge to take over the liabilities (current exit value). The evaluation of assets is significantly less complicated than that of insurance liabilities, for which no liquid market with observable prices exists. In the evaluation of technical provisions, a distinction is made between hedgeable and non-hedgeable risks. Non-hedgeable risks have to be evaluated as the present value of future cash flows (best estimate) plus a risk margin.

The calculation of the required capital adequacy, the Solvency Capital Requirement (SCR), is meant to limit the likelihood of a bankruptcy in which the market value of the assets is lower than the amount of actuarial reserves to less than 0.5% over the course of the subsequent 12 months. In order to calculate the SCR with this probability of default, actuarial, market, default and operational risks are taken into consideration, and stress scenarios, in which various risk factors are shocked, are calibrated according to a probability of default of 0.5%. Because the shocks of the risk factors have an influence on both the assets and liabilities side, their effect on the difference between assets and technical provisions can be calculated. The amount of the SCR is determined in such a manner that this difference does not become negative after applying the shock scenarios.

² Several adjustments are likely to be made prior to the final implementation of Solvency II.
One of the primary objectives of the quantitative requirements of Pillar 1 is covering the SCR with the eligible capital of the insurance companies (see Fig. 20). The relevant key indicator for coverage is the SCR coverage, the ratio between available capital and the SCR. An SCR coverage of more than 100% is required. The second objective is related to the MCR, a parameter between 25 and 45% of the SCR. If available capital falls below this threshold, supervisory measures are taken against the insurance company.

As shown in Fig. 21, the SCR is made up of various modules in QIS5.

The SCR is calculated as the sum of the Basic Solvency Capital Requirement (BSCR), requirements for operational risk and adjustments for risk-reducing effects from the loss-absorbing capacity of technical provisions and deferred taxes.
Quantitative Impact Studies

In order to test the appropriateness, applicability and implementability of Solvency II, the European Insurance and Occupational Pensions Authority (EIOPA, formerly CEIOPS) has been conducting Quantitative Impact Studies (QIS) since 2005. The five field tests give insurance companies the possibility to take any measures required and influence the European Commission in the determination of the standard model for the Solvency Capital Requirement. The implementation of the tests is meant to measure the effect of the regulatory measures on the European insurance market. Of the 3700 European insurers and reinsurers that are subject to the Solvency II regime, more than 2500 companies participated in QIS5. With a total surplus of eligible funds over the SCR of approximately EUR 360 billion, the financial situation of the European insurance industry is referred to as “comfortable” in the QIS5 results. The reduction of this surplus since Solvency I (approximately EUR 470 billion) indicates a tightening of the regulatory measures. 15% of the companies were identified as being below the SCR and 4.6% even fell short of the MCR.

The results of QIS5 indicate that equity risk has a significant influence on the SCR, even though it represents an average share of only approximately 10%. The amount of securitization for equities is related to the strong shocks of this asset class under QIS5. The technical specifications of QIS5 define the following shocks in the market module:

- Interest shock: +/-70% (relative) of short interest to +/-25% of long interest.
- Equity shock: OECD equities: -29 to -49%, non-OECD: -39 to -59%, depending on the performance of the market. In the case of a global equity market trend above the three-year average, the shock is greater.
- Real estate: -25%.
- Credit spreads: Shocks of absolute -0.9 to -7.5% depending on the rating of the bond, multiplied by the duration of the bond. The lack of consideration of the credit risks of European government bonds and the low capital adequacy of bonds without any rating compared to high yield bonds is a controversial issue.
- Currency shock: +/-25%.
- Concentration: If the exposure of a counterparty exceeds a certain threshold, this influences the SCR. The amount of the shock and the threshold depend on the issuer rating.

A look-through is applied to a company’s assets when calculating the effect of these shocks. This requires an understanding of all the securities in collective investments.

Additionally, it must be noted that positive as well as negative interest rate shocks and currency shocks are specified. The reason for this is their simultaneous influence on the assets and liabilities side of insurance company balance sheets. An interest increase reduces the value of bonds and of obligations. This risk-reducing effect is accounted for in the adjustment term in the first formula on page 31.

The following section examines the effect of convertible bonds in the portfolio of insurance companies and focuses on the market model, particularly on equity risk. It confirms the intuition that convertible bonds, with their convex profile, partially absorb negative equity market shocks and accordingly have lower solvency capital requirements.

Convertible Bonds under Solvency II

The shock scenarios of -29 to -49% on OECD equities and -39 to -59% on non-OECD equities have a significant effect on the SCR. The exact calculation of an SCR increase with a 1% rise in equities can only be done individually for each insurance company because the SCR in Fig. 21 is not a simple sum of the modules, nor is the market module a simple sum of the risk factors. The values of all SCR modules and the factor exposures have to be known.

Fortunately, QIS5 supplies these values for an “average” EU insurance company. For the following analyses, a typical life insurer is modeled using the parameters of the QIS5 technical specifications, and the effect of equities and convertible bonds on the amount of the SCR is examined. Details on these specifications can be found in Appendix 2. On 31.12.2011, the magnitude of the equity shocks was established at -43% for OECD equities and at -47% for non-OECD equities.

The following principal conclusions can be drawn from the modeling of an insurer whose main risks correspond to the life insurance on the basis of the QIS5 results:

- Every EUR 1 reduction of the equity portfolio leads to a EUR 0.39 reduction of the SCR.
- For typical life insurers, a 1% reduction of the equity exposure in favor of cash leads to an increase in the SCR coverage from 165 to 173%.

In the long run, a reduction of the equity weighting and an increase in cash will naturally cut into profits. Consequently, it must be ascertained whether other profitable asset classes with lower capital requirements could be considered as an alternative.

Convertible bonds on the assets side of the balance sheet have three advantages: they require less solvency capital, have equity-like characteristics and exhibit significantly lower volatility.

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6 Insurance companies with a gross premium income under EUR 5 million or technical provisions under EUR 25 million are not subject to the Solvency II regime.
7 EIOPA Report on the Fifth Quantitative Impact Study (QIS5) for Solvency II (14.03.2011).
8 The modeling of a typical life insurer primarily permits an analysis of changes in the SCR. The actual quantities (SCR, SCR coverage, etc.) may differ slightly from the typical insurer, due to the calibration of the model. This does not alter the implications of the study.
If equities are reduced in favor of global focus convertible bonds, the SCR coverage is increased and the SCR decreases. In the case of the typical life insurer from QIS5 in our model, the following conclusions apply:

- Every increase in the convertible bond component by EUR 1 in place of equities leads to a reduction of the SCR by EUR 0.18.
- A 1% replacement of equities with convertible bonds leads to an increase in the SCR coverage from 165 to 168%.
- This effect on SCR coverage can be increased with solvency-optimized convertible bond strategies.

According to QIS5, the average equity weighting of insurance company portfolios is 14%. According to the German Insurance Association, the equity allocation of German insurance companies is 4%. For this report, a percentage of 10% is assumed (for detailed specifications, see Appendix 2). Fig. 22 shows the effect of a gradual increase in convertible bonds financed by a reduction of global equities.

Optimized convertible bond strategies can clearly increase the effect on the SCR coverage. In addition to the convexity, rating, maturity and similar solvency-relevant parameters, such a strategy has to take diversification and liquidity aspects into consideration.

As Fig. 22 shows, convertible bonds can increase the SCR coverage of an insurance company if they are added to a portfolio in place of equities. The following three scenarios are examined to illustrate the influence of such an increase in SCR coverage on the change in risk/return characteristics:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Expected return on global equities</th>
<th>Expected return on global convertible bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>3%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Fig. 23 shows that the SCR coverage rises in all three scenarios when the convertible bond exposure is increased. In the first scenario, in which the expected return for global equities is 2% higher than the return for global convertible bonds, the Sharpe ratio barely changes. Scenario 2 assumes that expected returns are at the same level. In this case, the positive effect on the Sharpe ratio is a result of the lower volatility of the convertible bonds. If the expected return is assumed to be lower for equities than for convertible bonds – as has been the case in the last 10 years – it is likely that the Sharpe ratio will increase at a particularly rapid rate along with an increase in the SCR coverage.

The Swiss Solvency Test – the Supervision of Insurance Companies in Switzerland

The Solvency project for Swiss insurance companies in its present form was first launched in 2003. After the two field tests in 2004 and 2005 and the obligatory field test in 2006, the SST has been applied in Switzerland since 2008. Compliance with the capital requirements prescribed by the SST has been mandatory since 2011.

Like Solvency II in the EU, the SST aims to safeguard the actual risk situation of insurance companies with a view to protecting the insured in extreme situations. The equivalence test conducted at this time is meant to facilitate market access for Swiss insurance companies with subsidiaries in the EEA and prevent duplication in supervision.
The equivalence of the two systems, already given today as far as the quantitative requirements of Pillar 1 are concerned, leads to similar implications in relation to the capital adequacy of insurance and reinsurance companies.

The Credit Suisse Global Convertibles team has developed SST market and credit risk software to quantify the change in capital adequacy among various asset allocations. The main characteristics of the SST software are:

- Measurement of the change in capital adequacy when asset allocation is changed.
- Calculation of portfolio sensitivities with respect to equity, interest rate, credit spread, volatility and real estate price shocks.
- Evaluation of bonds, equities, options, convertible bonds and real estate (can be extended to additional asset classes) under the specific shocks prescribed by FINMA.
- Modeling of market risks using Delta-Gamma Monte Carlo simulation (introduced in the SST in 2011) in addition to the prescribed shock scenarios.
- Measurement of credit risks.

The determination of capital adequacy in the SST is accomplished through a stochastic simulation of assets and liabilities in insurance company balance sheets. In this context, the market- and insurance-specific factors prescribed by FINMA are simulated in accordance with their historical distribution characteristics. In each simulation step (shock), assets and liabilities are reevaluated and the amount of the risk-bearing capital is determined from this. The amount of the required capital adequacy (the SST term in this case is “target capital”) is set at a level where enough capital remains for a run-off in an average of 1% of the worst-case scenarios involving a decline in risk-bearing capital.

In addition to the simulation of the shocks for a one-year period, the sensitivity of the assets and liabilities has to be determined with respect to the relevant factors. For instance, the sensitivity of a bond on the amplitude of the prescribed five-year risk-free interest rate has to be calculated. Convertible bonds, which react differently to equity, interest, credit spread, volatility and currency shocks, also have to be evaluated with respect to more than 70 different market shocks.

The Credit Suisse SST software allows basic statements to be made about the change in target capital with the given structure of assets and liabilities. In a first step, the sensitivity of a portfolio (assets and liabilities) is calculated with respect to market factors. In a second step, the distribution of the change in risk-bearing capital is simulated in accordance with current FINMA guidelines. The prescribed shock scenarios and the credit risk are also taken into consideration. The simulation of the risk-bearing capital of the simplified sample company described in Appendix 3 is illustrated in Fig. 24.

The amount of the target capital in this example is CHF 5.8 billion. If the company’s risk-bearing capital is CHF 7 billion, the solvency ratio is about 121%. If Swiss equities on the assets side are replaced with convertible bonds (with a BBB rating) to the amount of CHF 1 billion, the level of the target capital is reduced even though the interest rate and credit risks are slightly higher. The new distribution of the change in risk-bearing capital is illustrated in Fig. 25.

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10 We would like to thank Dr. Hansjörg Furer and Dr. Luca Alberucci of FINMA for their valuable insights.
11 The liabilities side is modeled with long-term bonds; insurance-specific shocks are not implemented at this time.
12 FINMA guideline on the SST market risk standard model dated 26.10.2011.
The equity sensitivity of the assets is reduced as a consequence of convexity and the related risk-reducing effect of convertible bonds. Despite the rise in sensitivity to short interest rates and credit spread factors (which in this example are not hedged), the expected shortfall of the market risks declines by CHF 0.28 billion from CHF -5.08 billion to CHF -4.80 billion. The rise in credit risks recorded outside of the market model is CHF 0.08 billion. As a result of the two effects, the target capital is reduced by CHF 200 million through the transaction.

The above calculations were performed with convertible bonds with BBB rating. This is relevant in that the credit risk depends on the rating of the bonds. According to the Swiss Capital Adequacy Ordinance dated 01.01.2011, appendix 2, the risk weightings for corporate bonds are as follows: 25% (AAA and AA), 50% (A), 100% (BBB, BB, and no rating), 150% (B, CCC). To determine the underlying capital, the present value of the bond is multiplied with the corresponding risk weighting and then by 8%. The securitization for BBB rated bonds is then 8%, which explains the increase in the credit risk from CHF 720 million to CHF 800 million in the above example. If bonds are purchased with an A rating instead of a BBB rating, the credit risk increases by only CHF 40 million. The target capital is then reduced by approximately CHF 240 million to CHF 5.56 billion.

In addition to the rating of convertible bonds, their convexity is also of decisive importance. The convexity, in turn, depends on various parameters, for example the value of the underlying equities, strike and residual maturity term. The Credit Suisse Global Convertibles team is currently developing strategies that take these parameters into account, as well as diversification and liquidity in the context of Solvency II and the SST. A more pronounced effect on the SCR coverage than in the studies presented here is likely.

With an assumed equity allocation of 5%, equities in Fig. 26 are gradually replaced with convertible bonds and the effect on the SCR is measured. It becomes clear that in the case of a sample company with CHF 100 billion in assets, an increase in convertible bonds by CHF 1 billion, or 1%, increases the solvency ratio by about 5%.

Examining the risk/return characteristics of the assets in connection with the change in the solvency ratio (as in the Solvency II example specified above), it becomes clear that the Sharpe ratio, as well as the solvency of an insurance company, can be increased when the convertible bond exposure is increased. Based on the same scenarios regarding expected returns as in the Solvency II example (Scenario 1: equities 7%, convertible bonds 5%; Scenario 2: 5%, 5%; Scenario 3: 3%, 5%), this effect is illustrated in Fig. 27.

Fig. 27: Change in the Sharpe ratio and solvency ratio in various scenarios in the SST
The target return is not a projection, a forecast or a guarantee of future performance or returns.
C. and G. Zangaki: French freighter on the Suez Canal
Credit Suisse Global Convertibles

Global Convertible Bonds
Our successful track record in managing convertible bonds stretches back to 1984. Since that time, our aim has been to offer our clients the best possible solutions for convertible bonds through our funds and mandates. Winning the Lipper Fund Awards in 2011, 2012, 2013 and 2014 is a gratifying endorsement of our work.

Our global products provide a very high degree of diversification and are all guided by a clearly defined investment process. Various benchmark-based approaches are applied, with or without currency hedging and global, yield-oriented strategies.

The Investment Process
The Credit Suisse Global Convertibles investment process is based on four elements:
- Quantitative screening of the convertible bond universe.
- Qualitative input from Credit Suisse’s global research and from external sources.
- Instrument selection: consideration of convertible-specific features.
- Investment controlling.
The Investment Process

The Credit Suisse Global Convertibles investment process is based on four basic elements. Through quantitative screening, a consistent method is applied to identify securities with attractive risk/return potential. These securities are also investigated in detail in terms of their credit quality and upside potential. The individual qualities such as call and put dates of each of the convertible bonds are analyzed. Through investment controlling, guideline checks are conducted and risks and realized returns are regularly reviewed.

![Fig. 28: Credit Suisse Global Convertibles investment process](image)

The four components of the investment process are described below. A description of the tools used in quantitative screening (CreditSights, HOLT™ and Northfield) can be found in Appendix 4.

Quantitative Screening

The aim of quantitative screening is the consistent filtering of the global convertible bonds universe for prospective returns and risk potential. This presents a challenge in several respects. Depending on how the price of the relevant shares moves, convertible bonds, as hybrid instruments, can behave like shares or like corporate bonds. They also often behave somewhere in between the two, where their convexity is most noticeable. Therefore, a careful distinction has to be made when looking at prospective returns. In the case of convertible bonds that behave like bonds, issues of credit quality and interest rate sensitivity play a larger role. In the case of convertible bonds that are in-the-money and therefore have a higher level of equity sensitivity, the company valuation of the underlying shares is focused upon at an increased rate. We make use of several tools tailored to dealing with these issues: CreditSights is used to assess credit quality, whilst HOLT Lens™ serves the purpose of company valuation. To ascertain the potential returns from a convertible bond, the scores generated by these tools are weighted on the basis of the equity sensitivity (delta) of the convertible bond.

![Fig. 29: Quantitative convertibles screening for Credit Suisse Global Convertibles](image)

Fig. 29 shows how the quantitative screening of convertible bonds works. When assessing prospective returns, the scores from CreditSights (credit tool) and HOLT Lens™ (company valuation tool) are weighted based on the convertible bond’s equity sensitivity. This means that the resulting score (0 to 100) for convertible bonds with a high degree of convexity (medium delta) will be between the scores from CreditSights and HOLT Lens™. We use this return score as a proxy for securities’ prospective returns.

Whether a security is attractive in the context of the portfolio also needs to be assessed from the risk perspective. The marginal tracking errors calculated by Northfield – a measure of the increase in the relative risk against the benchmark for an increase in a position – are also given scores (0 to 100), with a high score indicating a low or even negative risk contribution. Securities with a high return score and a high risk score are regarded as attractive: an increase in the prospective return may reduce the tracking error for the portfolio. On the other hand, securities with low scores should be underweighted.

Combining the return score and the risk score gives a total score:

$$\text{Total score} = \left(1 - \delta\right) \times \text{credit score} + \delta \times \text{equity score} + \text{risk score}$$

Aside from the analysis of potential returns, the management of portfolio risk is crucial. Here, too, convertible bonds with their embedded option have to be assessed correctly in terms of risk. Risk is assessed separately for each convertible bond and for each portfolio. This is important because the marginal risk contribution – the second key metric along with prospective returns – depends not just on the convertible bond, but also on the rest of the portfolio. For instance, the marginal risk contribution for a bond with a medium credit spread may be positive in an investment grade portfolio, but negative in a sub-investment grade portfolio. To measure the effect of an increase or decrease in portfolio risk, we use the risk assessment tool Northfield.
As all scores are between 0 and 100, this formula ensures that the total score also falls within this range. Using these scores, securities are preselected from the global universe and are then examined for qualitative and instrument-specific aspects. In the case of low scores, a reduction in the position is considered.

The way in which the three quantitative tools work is described in Appendix 4.

Qualitative Input
The portfolio management team for convertible bonds is assisted in its work by various specialized units within Credit Suisse. Asset allocation is therefore tied into the basic investment process at Credit Suisse. As one of the world’s leading financial services providers, Credit Suisse has an extensive global research capacity. This expertise is made available to the Portfolio Managers swiftly and efficiently through personal contact and/or via electronic media.

The many external research publications are another important source of input, especially strategy research on macroeconomic development and the development of equity, credit, interest rate and foreign exchange markets, plus specific research into individual equities and credits, and product-specific research into convertible bonds. Management also receives information on prevailing market conditions, such as liquidity levels, new issues or activities, and the movement of funds. This research and market information is made available by all the major brokers and investment banks in Europe, the US and Asia, as well as by independent research providers such as Ned Davis and Morningstar.

Furthermore, intensive use is made of standard and proprietary systems that assist in the decision-making process. Bloomberg and FactSet are two standard systems used for financial market and company information, and from these we garner a wide range of data that we feed into our quantitative screening system. Product quality and adherence to legal and contractual regulations and agreements are monitored on an ongoing basis by our efficient in-house controlling.

Instrument Selection
When selecting convertible bonds, their individual specifications are examined. During this process, the details of the prospectus, call and put features and risk metrics are particularly taken into account. The central properties of convertible bonds that are of relevance when selecting an instrument are described at the beginning of this report.

Investment Controlling
Special importance is attached to investment controlling. Credit Suisse’s Private Banking & Wealth Management division has two departments that assist the Portfolio Managers in the day-to-day control of processes and functions at our bank:

Risk Management/Product Control
Risk management is responsible for the independent monitoring and control of product quality in asset management. The aim is to ensure proper performance and quality and thereby make sure clients receive the benefit they should.

Operational risks within the Credit Suisse Private Banking & Wealth Management division are monitored by means of a comprehensive operational risk management system. Internally developed monitoring systems allow for the detailed evaluation of settlement processes. Evaluations, such as those concerning same-day processing or process/settlement errors, are regularly assessed by independent units.

Compliance Office
Compliance essentially signifies the identification, management, reduction and avoidance of legal and reputational risks. Compliance supports and assists staff and management in their adherence to regulatory provisions and the code of conduct. Areas covered include client identification (“Know your Customer”), the prevention of money laundering and ethical and client-specific standards in asset management.
J. W. Taylor: Masonic Temple, Chicago, around 1890
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Schmeiser, Hato, *Die Auswirkungen des SST auf die Strategie und das Geschäftsmodell der Lebensversicherer*, University of St.Gallen, 2011.


Edward Marony: railway carriage, constructed by The Harlan & Hollingsworth Company, Delaware, 1886
Appendices

Appendix 1
Input Factors for Simulating Convertible Bonds in Mixed Profiles

Appendix 2
Modeling of a Life Insurance Company in Accordance with Solvency II

Appendix 3
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Appendix 5
Convertible Bond Benchmarks
Appendix 1
Input Factors for Simulating Convertible Bonds in Mixed Profiles

The input factors shown in the table below were used for the efficient frontier simulation of the mixed portfolio with and without convertible bonds in Fig. 30. The expected returns are based on historical values (shares and convertible bonds) and on current yields (bonds). Upper and lower limits were set for the optimization in such a way that there would be a sufficient spread of individual weightings without affecting the main results of the simulation. The covariance matrix was calculated using weekly total return data from January 2009 to December 2013.

To enhance the robustness of the simulation, a resampling procedure was applied and a version using global equities without currency hedging since 2001 was calculated. For shares without currency hedging, convertible bonds accounted for a higher share of low-risk profiles. This is attributable to the higher volatility of shares without currency hedging.

<table>
<thead>
<tr>
<th>Index name (Bloomberg ticker)</th>
<th>Expected return</th>
<th>Volatility</th>
<th>Lower limit</th>
<th>Upper limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government bonds</td>
<td>JPM GBI Global Hedged CHF (JHSCGBIG)</td>
<td>2.1%</td>
<td>3.2%</td>
<td>0</td>
</tr>
<tr>
<td>Corporate bonds</td>
<td>BarCap Global Aggregate Corporate Hedged CHF (LGCPTRCH)</td>
<td>4.1%</td>
<td>4.0%</td>
<td>0</td>
</tr>
<tr>
<td>High yield</td>
<td>BarCap Global High Yield Hedged CHF (LG30TRCH)</td>
<td>6.0%</td>
<td>8.2%</td>
<td>0</td>
</tr>
<tr>
<td>Global equities</td>
<td>MSCI World Hedged CHF (WHANWHC)</td>
<td>8.0%</td>
<td>19.6%</td>
<td>0</td>
</tr>
<tr>
<td>Convertible bonds</td>
<td>UBS Global Convertibles Hedged CHF (source: UBS)</td>
<td>7.0%</td>
<td>12.4%</td>
<td>0</td>
</tr>
</tbody>
</table>

Fig. 30: Input factors for the simulation of convertibles in mixed profiles

The target return is not a projection, a forecast or a guarantee of future performance or returns.

Appendix 2
Modeling of a Life Insurance Company in Accordance with Solvency II

In order to investigate the effect of changes in an insurance company’s portfolio on its capital adequacy, a typical European insurance undertaking is modeled with an asset allocation as shown in Fig. 31.13

The model insurance company’s portfolio is specified in detail in Fig. 31. It is assumed that no convertible bonds are initially held. The index names in the first column define the investable universe for the position in question. The SCR sub-modules provide information on the composition of the SCR market module (see Fig. 21).

<table>
<thead>
<tr>
<th>Life insurance company Model</th>
<th>QIS5</th>
<th>GDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed income</td>
<td>75</td>
<td>62</td>
</tr>
<tr>
<td>Equities</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Real estate</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Cash</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig. 31: Portfolio composition for model life insurance company in comparison with an average life insurance company as per QIS5, and with the average portfolio of German life insurers according to the German Insurance Association (GDV)

Sources: EIOPA, GDV, Credit Suisse AG

<table>
<thead>
<tr>
<th>Currency</th>
<th>Weighting</th>
<th>SCR Equity</th>
<th>SCR IR</th>
<th>SCR spread</th>
<th>SCR Currency</th>
<th>SCR Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barclays Capital Euro Treasury Bond Index</td>
<td>EUR</td>
<td>35%</td>
<td>0</td>
<td>-6.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Barclays Capital Euro Corporate Bond Index</td>
<td>EUR</td>
<td>35%</td>
<td>0</td>
<td>-3.9</td>
<td>-9.5</td>
<td>0</td>
</tr>
<tr>
<td>Barclays Capital Euro Treasury Bond Index</td>
<td>USD</td>
<td>5%</td>
<td>0</td>
<td>-3.2</td>
<td>-3.3</td>
<td>-25</td>
</tr>
<tr>
<td>MSCI All Countries World (hedged EUR)</td>
<td>EUR</td>
<td>10%</td>
<td>-44</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Real Estate (EUR)</td>
<td>EUR</td>
<td>5%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Global Focus Convertibles Bonds (hedged EUR)</td>
<td>EUR</td>
<td>0%</td>
<td>-14.6</td>
<td>-2.3</td>
<td>-9.5</td>
<td>0</td>
</tr>
<tr>
<td>Cash</td>
<td>EUR</td>
<td>10%</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

SCR sub-module (excluding diversification) | 39% | 32% | 34% | 11% | 11% |

Diversification | -27% |

Total | 100% |

Fig. 32: Portfolio composition and SCR risks for model life insurance company

13 See QIS5 Report, pages 36 and 37, and Statistical Yearbook of German Insurance 2011, page 46. Excludes reinsurance assets and unit-linked products.
In a next step, the SCR modules for the model insurance company are calculated on the basis of the portfolio from Fig. 32 and in line with the shocks specified in QIS5. For the sake of simplicity, total assets of EUR 100 million are assumed (the absolute values are in EUR millions). Fig. 33 shows the results of the modeling, with 1% convertible bonds and 9% equities and with 5% convertible bonds and 5% equities in comparison with 10% equities and no convertible bonds. In this example, the solvency capital requirement is reduced from EUR 8.9 million to EUR 8.8 million and EUR 8.1 million if convertible bonds of EUR 1 million and EUR 5 million are added to the portfolio. The SCR coverage increases, in the case of an assumed level of eligible capital of EUR 15 million, from 165 to 168 and 183%, respectively.

A comparison of the last two columns in Fig. 33 provides confirmation that the model is realistically calibrated: the model EU life insurance company in the standard case without convertibles produces results similar to those of the average EU life insurance company under QIS5. The correct model calibration is important in terms of enabling realistic conclusions about the magnitude of the effects under investigation.

Appendix 3
An Example of Insurance under the Swiss Solvency Test

In the text on page 34, a simplified example for the purpose of analyzing convertible bonds under the SST was discussed. In this example, 80% Swiss government and corporate bonds14, 10% cash, 5% Swiss equities and 5% property are held (initially no convertible bonds). The duration of the bonds is 10 years. A simplified approximation is made for the liabilities side with a bond with a 15-year maturity and a coupon of 10%. Despite this simplification of liabilities, the size of the factor sensitivities is well reflected, as a comparison with the results of the 2011 field test shows.

The added convertible bond is at-the-money and has an implied volatility of 50%, a rating of BBB, a coupon of 3% and a four-year maturity. An optimized convertible bonds strategy would enable the effect on increasing the solvency ratio to be maximized.

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14 In this example, currency-hedged US Treasuries would produce the same result.
Appendix 4
CreditSights, HOLT™ and Northfield

The investment process for Credit Suisse Global Convertibles uses inputs from various tools with the aim of ensuring consistent management of risk and return that takes account of features specific to convertible bonds. These tools are described below.

CreditSights
CreditSights is an independent company that specializes in credit research. It was established in 2000 and works mainly out of London and New York with up to 80 analysts. In addition to qualitative credit analysis, CreditSights also operates a quantitative model covering 8500 companies worldwide.

Through its BondScore application, CreditSights supplies a wide range of key data of relevance to convertible bonds. These include:

- **Credit Risk Estimate (CRE):** probability of the company defaulting in the next 12 months
- **Credit Risk Trend:** change in the CRE in the last six months
- **Ratings Transition Outlook:** the probability of a downgrade by at least two levels by rating agencies in the next 12 months
- **Trading Signal:** comparison of the model CDS value with the five-year market CDS for the company

The first key data differs from the other three in that it reflects a particular credit default probability at a given time and not the potential change in that probability. Securities with a high yield-to-maturity generally have a high CRE model value. It is particularly important to identify these if there is no agency rating available.

The other key data is also of interest from the portfolio management perspective because it forecasts the change in credit quality. A correct prediction of this change can point to the possibility of incorrect valuation, in which the default risks are overestimated or underestimated by the market. When calculating the credit score, these four indicators are equally weighted. This weighting places the emphasis on forecasting the change in credit risks.

To calculate the above key data, CreditSights uses a proprietary two-stage model. In the first stage, an adapted variant of the Merton model is applied (instead of a European call option, it uses an American call option for more realistic modeling). In the second stage, the value produced by this model and the fluctuation in company assets are entered into a statistical model. This involves regression of these variables along with fundamental company data (e.g. company alpha, operating margin, company size) and macroeconomic data (e.g. output, unemployment, stock market performance) on the basis of historical default events. The aim of the regression is to ascertain the sensitivity of the factors mentioned in relation to a company’s probability of default. The most accurate reflection of the probability of default can be achieved by minimizing false negative errors and false positive errors. A false negative error in this context is an incorrect classification as “not in danger of default” for a company that does default, and a false positive error is an incorrect default prediction for a solvent company. To calibrate and assess prediction quality, in and out-of-sample data from US and European corporate defaults between 1976 and 2008 has been used.

The results of the CreditSights model can be shown by looking at the forecast of company downgrades and upgrades by rating agencies.

Fig. 34 shows out-of-sample tests of forecast quality from CreditSights with regard to changes in agency ratings of companies. In over 80% of cases, downgrades and upgrades in the next 12 months were predicted correctly (true positives). Cases in which a downgrade or upgrade was predicted but did not occur amount to around 20% over the years.

15 A measure of this kind of forecast quality is the Gini coefficient. According to CreditSights, this coefficient comes to 0.84 in its out-of-sample tests of US and European corporate defaults. Values above 0.5 can be regarded as good.
HOLT Lens™

For company valuation for the shares underlying convertible bonds, the Credit Suisse HOLT™ system is used. HOLT™ was developed at the beginning of the 1980s and was first used by the Boston Consulting Group in 1991 before being adopted by Credit Suisse in 2002 and further developed. The system covers 20,000 companies in more than 64 countries and uses the trademark-protected CFROI (Cash Flow Return on Investment) approach.

The CFROI is essentially a discounted cash flow approach with the focus on real values instead of nominal ones. Inflation-adjusted cash flows are used in the valuation of companies, which makes it easier to compare companies over time and across regions. The calculation of the CFROI requires four variables: the initial inflation-adjusted gross investment in the company, the inflation-adjusted gross cash flows, an estimate of the average project length and the future value of non-depreciable assets at the end of the project period. It is assumed that non-depreciable assets, such as land and current assets, can be sold or reinvested at the end of a life cycle. The CFROI is an internal rate of return: the future cash flows discounted using this rate give the gross investment value in the company.

The HOLT™ approach has two advantages:

- Consistent, fundamental valuation of global companies in different sectors and with different accounting practices
- Focus on real economic factors makes it easier to compare companies under different inflation rates

HOLT™ focuses on the economic view. Accounting measures that affect the profits a company posts but not its value should not be part of the assessment of potential returns. If R&D expenditure is cut, higher profits will be recorded in the short term, but the economic effect on the company may very well be negative. The CFROI takes account of this by changing the input parameters.

HOLT Lens™, the Web-based HOLT™ solution, shows both the CFROI and other company-specific key data, as well as a total score for the company. We use the HOLT™ scorecard to value the shares underlying convertible bonds. This is scaled from 0 to 100 and assigned to the equity score. As explained above, the equity score is weighted against the credit score according to the delta for the convertible bond.

On the HOLT™ scorecard, operational performance, valuation and momentum are each given a weighting of one-third. These three inputs are produced using key data that is consistent with the HOLT™ approach. The main input for the valuation component is the difference between the current share price and the HOLT™ price for the shares. In this approach, a significantly higher HOLT™ price indicates an undervaluation of the company.

In addition to price momentum and liquidity, the momentum component also takes account of the change in the CFROI level should the company’s earnings forecasts change.

The historical success of the HOLT™ valuation can be seen in Fig. 35.

![Fig. 35: HOLT™ backtesting from January 1990 to December 2010](image)

Hypothetical, historical or simulated past results are neither an indicator nor a guarantee of future gains.

For the backtesting in Fig. 35, companies in developed and emerging market countries were divided into five groups per sector according to the HOLT™ approach. The first group (first quintile) contains companies with the highest HOLT™ score, the fifth group those with the lowest score. Fig. 35 shows the relative return for these groups in comparison with the global equities universe in developed and emerging economies. With a cumulative annual return of over 4%, the group with the highest HOLT™ score significantly outperformed the global equities universe.

The transparency of the HOLT™ approach is enhanced by the indices calculated by HOLT™. These are calculated and published on a daily basis. Taking its cue from the success of the HOLT™ approach, Credit Suisse launched a number of public equity funds in mid-2011, based on HOLT™ indices.
Northfield

Founded in 1985 by Dan diBartolomeo, Northfield is one of the leading providers of financial software for risk management and analysis. For over 20 years, its well-documented models have been applied to portfolio construction and risk control, as well as to other financial market analyses. These models use the same factor structure for different asset classes, enabling results to be aggregated across national and regional levels. Northfield has a proven track record in multi asset class risk modeling. Time series models are enhanced with both fundamental and statistical factors in order to take into account the specific characteristics of each asset class.

Appendix 5

Convertible Bond Benchmarks

Benchmark: UBS Convertible Global
The UBS Global benchmark is based on the full spectrum of available convertible bonds including mandatory convertible bonds. This basic stock of securities is then filtered using specific minimum requirements with regard to size and liquidity in order to create the actual benchmark composition. The minimum requirement for issue volume is between USD 100 million and USD 300 million, depending on the region. This benchmark has the highest level of equity market sensitivity.

Benchmark: UBS Convertible Global Focus
The UBS Focus benchmark series attempts to filter out the basic stock of securities for the UBS Convertible Global indices by means of a regular rebalancing process in order to identify those convertible bonds that best fit a balanced profile. Specifically, a convertible bond must have a premium of less than 100% to be included in a Focus index and the price has to be below 140% of the nominal value. To produce a benchmark that suits best the conventional convertible bonds profile, equity-like convertible bonds are eliminated (e.g. mandatory convertible bonds).

Benchmark: UBS Convertible Global Focus Investment Grade
In addition to applying the Focus filter described above, this benchmark only includes issuers with proven credit quality. This universe provides investors with a high level of security for investments. The convex profile of the bonds included limits the investment risk on account of their relative proximity to their bond floor. In addition, the high level of issuer credit quality should go a long way to limiting the risk of the bond floor dropping. The selective choice of securities may have a detrimental effect on the level of diversification in certain market phases.
Unidentified photographer: Carrosserie J. Rothschild & Fils, Auscher & Cie: omnibus with six seats, two at the front, made of wood, Reims, around 1900
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accrued interest</td>
<td>Interest accrued on the convertible bond</td>
</tr>
<tr>
<td>Anti-dilution clause</td>
<td>Clause to protect investors against dilution resulting from changes to the conversion ratio as a result of capital increases, share splits, etc.</td>
</tr>
<tr>
<td>At-the-money</td>
<td>The share price is close to the strike price of the option. The convertible bond is highly convex.</td>
</tr>
<tr>
<td>Bond-floor</td>
<td>Value of the corporate bond (the convertible bond without its option component); cash value of future income streams if the conversion option is not exercised</td>
</tr>
<tr>
<td>Busted convertible</td>
<td>Convertible bonds with very poor credit quality and high yields</td>
</tr>
<tr>
<td>Call</td>
<td>The right of the issuer to redeem a convertible bond at a fixed price before the maturity date</td>
</tr>
<tr>
<td>Call option</td>
<td>An option conferring the right to purchase the underlying shares at a fixed price; convertible bonds are corporate bonds with an embedded call option</td>
</tr>
<tr>
<td>Clean price</td>
<td>Price that does not include accrued interest</td>
</tr>
<tr>
<td>Contingent convertible bond (CoCo bond)</td>
<td>Mandatory convertible bond that is converted into shares if predefined conditions occur (e.g. if a certain capital ratio is no longer achieved); CoCo bonds have a fundamentally different payoff to convertible bonds. They are therefore not included in the convertible bond universe</td>
</tr>
<tr>
<td>Conversion period</td>
<td>The period during which convertible bonds may be converted into the underlying shares</td>
</tr>
<tr>
<td>Conversion premium</td>
<td>Percentage difference between the price of the convertible bonds and the value of the underlying shares (parity)</td>
</tr>
<tr>
<td>Conversion price</td>
<td>The price an investor has to pay to convert into shares; it is set when the convertible bond is issued; if parity is above this value at maturity, the bond will be converted</td>
</tr>
<tr>
<td>Conversion ratio</td>
<td>The ratio expressing the number of shares into which the convertible bond can be converted</td>
</tr>
<tr>
<td>Convertible preferred stock</td>
<td>Preferred stock that can be converted into bearer shares</td>
</tr>
<tr>
<td>Convexity</td>
<td>Describes the characteristic that a rise in the share price has a larger absolute effect on the price of the convertible than a fall in the share price of equal magnitude</td>
</tr>
<tr>
<td>Coupon</td>
<td>Amount of the interest payment on the convertible bond</td>
</tr>
<tr>
<td>Delta</td>
<td>Measure of equity market sensitivity</td>
</tr>
<tr>
<td>Dirty price</td>
<td>Price that includes accrued interest</td>
</tr>
<tr>
<td>Dividend yield</td>
<td>Dividend yield on the underlying shares</td>
</tr>
<tr>
<td>Exchangeable bond</td>
<td>The issuer of the convertible bond is not the same as the company into whose shares the bond can be converted</td>
</tr>
<tr>
<td>Expected shortfall</td>
<td>The average for the x% of worst observed losses</td>
</tr>
<tr>
<td>Gamma</td>
<td>Measure of convexity (change in the delta for a change in the share price)</td>
</tr>
<tr>
<td>Hard call protection</td>
<td>Period in which the investor is protected against a call on the part of the issuer</td>
</tr>
<tr>
<td>In-the-money</td>
<td>The share price is above the strike price for the option; high equity market sensitivity</td>
</tr>
<tr>
<td>Investment premium</td>
<td>Percentage difference between the price of the convertible bond and the bond floor</td>
</tr>
<tr>
<td>Investment value</td>
<td>Synonym for bond floor; value of the corporate bond (the convertible bond without its option component)</td>
</tr>
<tr>
<td>Issue price</td>
<td>The convertible bond is issued at this value</td>
</tr>
<tr>
<td>Mandatory convertible</td>
<td>Conversion of the convertible bond at maturity is mandatory. Mandatory convertible bonds have a high equity market sensitivity.</td>
</tr>
<tr>
<td>Maturity</td>
<td>Date on which the convertible bond matures</td>
</tr>
<tr>
<td>Negative pledge</td>
<td>An undertaking by the debtor not to pledge its assets as collateral in the future without offering existing creditors the same degree of security; serves as protection against dilution</td>
</tr>
<tr>
<td>Out-of-the-money</td>
<td>The share price is below the strike price for the option; low equity market sensitivity</td>
</tr>
<tr>
<td>Parity</td>
<td>The value of the shares into which a convertible bond can be converted</td>
</tr>
<tr>
<td>Put</td>
<td>The right of the investor to redeem the convertible bond early at a certain price and on a certain date</td>
</tr>
<tr>
<td>Put option</td>
<td>An option conferring the right to sell the underlying shares at a fixed price</td>
</tr>
<tr>
<td>Risk-bearing capital</td>
<td>Capital available to offset fluctuations in business performance (Solvency II/Swiss Solvency Test); this corresponds to the difference between the fair value of assets and the best possible estimate of discounted expected liabilities</td>
</tr>
<tr>
<td>SCR coverage</td>
<td>Solvency ratio defined as the ratio of available capital to SCR</td>
</tr>
<tr>
<td>Soft call</td>
<td>A call linked to the fulfillment of certain criteria (e.g. a trigger price)</td>
</tr>
<tr>
<td>Solvency Capital Requirement (SCR)</td>
<td>Regulatory solvency capital requirement under Solvency II. Intended to limit the probability of insurer bankruptcy to 0.5% p.a. Under the Swiss Solvency Test, the term &quot;target capital&quot; is used, with some differences in calculation.</td>
</tr>
<tr>
<td>Subordinated debt</td>
<td>Subordinated bonds; holders are paid after senior bond holders in the event of bankruptcy</td>
</tr>
<tr>
<td>Synthetic convertible</td>
<td>Synthetic financial product in which a financial institution imitates the payoff structure of a convertible bond</td>
</tr>
<tr>
<td>Theta</td>
<td>Time decay of the embedded option; daily loss in the option’s value if other factors remain unchanged</td>
</tr>
<tr>
<td>Trigger price</td>
<td>Level which has to be reached by the (share) price to trigger a specific event (soft call, mandatory conversion)</td>
</tr>
<tr>
<td>Yield advantage</td>
<td>The circumstance whereby the interest payment on a convertible is greater than the dividend yield on the underlying share</td>
</tr>
<tr>
<td>Yield to maturity</td>
<td>Annualized return (internal rate of return) on a convertible bond if it is held to maturity</td>
</tr>
<tr>
<td>Yield to put</td>
<td>Annualized return (internal rate of return) on a convertible bond if it is redeemed on the next put date</td>
</tr>
</tbody>
</table>
The Credit Suisse Global Convertibles Team

**Peter A. Schilling,**
*Degree in Business Administration, CEFA*

Peter A. Schilling, Director, heads the Credit Suisse Global Convertibles team. After completing his studies at the J. W. Goethe University in Frankfurt (from which he obtained a degree in Business Administration) in 1990, he worked in various asset management roles for Nassauische Sparkasse, Delbrück & Co. Privatbankiers and Deka Investment. Over the course of his career, he has gained experience in portfolio management in equities, fixed income, corporate credit and strategy as well as in the management of multi-asset-class mandates. His broad knowledge of the financial markets and over 20 years of capital market experience make him a highly qualified Senior Portfolio Manager. Peter joined Credit Suisse in 2008.

**Ralph A. Geiger, lic. oec. HSG**

Ralph A. Geiger, Director, has been a specialist in fixed income investments at Credit Suisse Asset Management since 2011. Ralph can look back on a 28-year career in the financial markets. After studying Economics at the University of St. Gallen, he worked for Merrill Lynch in New York, London and Zurich. In 1989, he took charge of institutional sales of fixed-income investments at SBC Securities. In 1994, he moved to the Geneva-based private bank Lombard Odier & Cie, before becoming head of the institutional fixed income team in Switzerland. His many years of market experience enable him to provide a valuable service to clients. Since 2011, Ralph has worked as a fixed-income specialist in fund distribution at Credit Suisse, providing advice and support to a range of client segments.

**Dr. Daniel Niedermayer**

Daniel Niedermayer, Director, is a Portfolio Manager in the Credit Suisse Global Convertibles team. Since he joined Credit Suisse in 2004, he has worked as a Performance Analyst, has headed the Quantitative Portfolio Engineering team and has been a Portfolio Manager for the Exclusive Selection mandates and the ETF based MyChoice mandate. Daniel studied Economics and Finance at the University of Bern and the University of Strathclyde (Glasgow). After his degree in Bern, he gained a doctorate from the University of Basel. For his thesis, which was graded summa cum laude, he won the faculty prize from the University of Basel. Daniel has authored a number of specialist publications in the area of portfolio optimization and operations research, and regularly speaks at international conferences.

**Vedran Stankovic, MsFin, CFA**

Vedran Stankovic, Assistant Vice President, is a CFA charterholder and Portfolio Manager in the Credit Suisse Global Convertibles team. Alongside studying for his master’s degree at the University of Zurich, which focused on Quantitative Finance and Economics, he worked as an assistant and tutor at the Swiss Finance Institute in Zurich. He began his career on Credit Suisse’s Career Start program working in the Credit Suisse Global Convertibles team, while also gaining experience in the MACS Product Specialists and Global Fixed Income divisions. In addition to managing convertible bond portfolios for institutional clients and retail funds, Vedran develops sophisticated, computer-assisted portfolio and risk management applications. Vedran joined Credit Suisse in 2008.