

The benefits of convertible bonds

White Paper Series



Convertible bonds have been an attractive investment in the past. But serious losses in 2005 at some hedge funds that engage in convertible bond arbitrage strategies contributed to concerns that convertible bonds might no longer be attractive.

In this paper, we attempt to summarize why we believe convertible bonds are attractive. They offer investors several benefits, such as convex pay-offs, diversification benefits, relatively cheap optionality, and they have exhibited outstanding risk/return characteristics in the past. From our point of view, various pieces of evidence suggest it is likely that convertible bonds will continue to show attractive risk/return characteristics in the future. Given this, we see a strong case for exposure to convertible bonds in a strategic asset allocation framework.

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Convertible bonds have been an attractive investment in the past. But—as the famous disclaimer says—past performance is no guarantee of future performance. Serious losses in 2005 at some hedge funds that engage in convertible bond arbitrage strategies contributed to concerns that convertible bonds might no longer be attractive.

We are convinced that convertible bonds offer investors attractive features, and we believe that they should continue to exhibit attractive risk/return properties in the future. Nevertheless, our experience shows that many investors do not have exposure to convertible bonds. One reason seems to be the complexity of these instruments and the philosophical question of whether they should be classified as equities or as bonds. Other explanations include misconceptions, like the idea that convertible bonds are a redundant investment that can be replicated by a dynamic combination of equities and bonds, as well as a general disbelief that the attractive risk/reward characteristics of convertibles are here to stay.

In the following we intend to summarize our thoughts about the attractiveness of convertible bonds. We argue that convertible bonds offer investors several benefits. First, they exhibit convex payoffs that appeal to many investors. Second, convertible bonds offer diversification benefits: Adding convertible bonds to a traditional equity / bond portfolio provides exposure to volatility, an additional source of diversification. Furthermore, convertible bonds tend to offer relatively cheap optionality, and have exhibited outstanding risk/return characteristics in the past. From our point of view, various pieces of evidence suggest a significant likelihood that convertible bonds will continue to show attractive risk/return characteristics in the future. Given this, we see a strong case for exposure to convertible bonds in a strategic asset allocation framework.

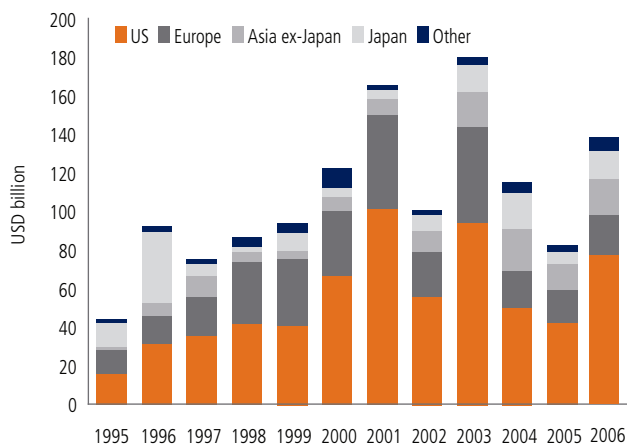
This paper is organized as follows: Section one gives a short introduction to the global convertible bond market. Section two discusses basic attractions of convertible bonds. Section three analyzes reasons why convertible bonds cannot be replicated, and therefore constitute an asset class in their own right. Section four addresses the tendency of convertible bonds to trade cheaply. Section five takes a look at past risk/return properties of convertible bonds.

1. The convertible bond market

The convertible bond market has grown significantly since the early days, when US railroad companies dominated issuance. Today companies very broadly use convertible bonds as a financing instrument irrespective of their sector or country of domicile. In addition, so-called exchangeable bonds (bonds which can be converted into shares of a company different than the issuing company) have become a common method used by companies and also governments to (potentially) dispose of nonstrategic holdings.

Exhibit 1 shows global issuance of convertible bonds annually since 1995. Even if there is some cyclical in convertible bond new issuance, there is a substantial stream of new issues coming to the market each year. Variations in convertible bond new issuance can be attributed to changes in companies' financing needs, levels of interest rates, implied volatilities,¹ and finally to changes in the regulatory environment.²

Exhibit 1: Annual convertible issuance 1995-2006



Source: UBS AG, MACE Advisors; Datastream.
Data as of December 31, 2006.

¹ Higher implied volatilities make the call options that are inherent in convertible bonds more valuable. Since a convertible bond issuer basically sells a call option, higher implied volatilities make convertible bonds relatively more attractive to issuers.

² Uncertainties related to the introduction of International Financial Reporting Standards (IFRS) in 2005 may have contributed to the depressed level of convertible bond new issuance in 2005.

Table 1 shows the global convertible market capitalization and number of outstanding issues as of the end of December 2006. The size and diversity of the convertible bond market give an indication that the market is broad and allows for appropriate diversification when constructing global convertible bond portfolios.

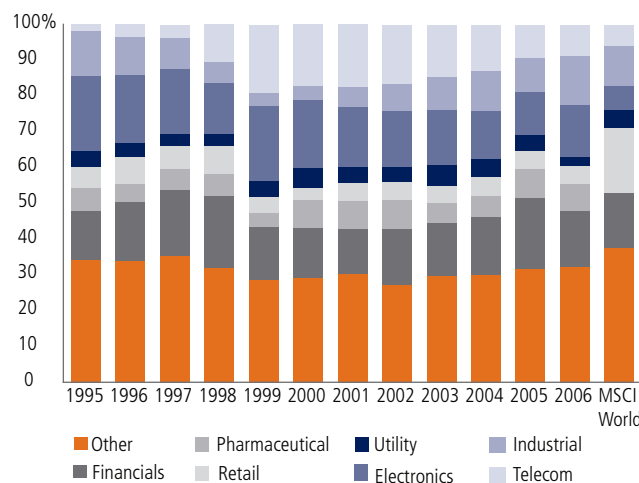
Table 1: Global convertible bond universe size

Region	USD billions	Number of convertible bonds
US	312	1,050
Europe	153	428
Japan	62	351
Asia ex-Japan	62	555
Other	24	183
Total	613	2,567

Source: UBS AG, MACE Advisors, Data as of December 31, 2006.

From a sector view, the global convertible market offers diversification possibilities that more or less match those available in the global equity market.³ Exhibit 2 shows the sector composition of the UBS Global Convertible Bond Index since

Exhibit 2: Global convertible bond sectors



Source: UBS AG, MACE Advisors; Datastream. Data as of December 31, 2006.

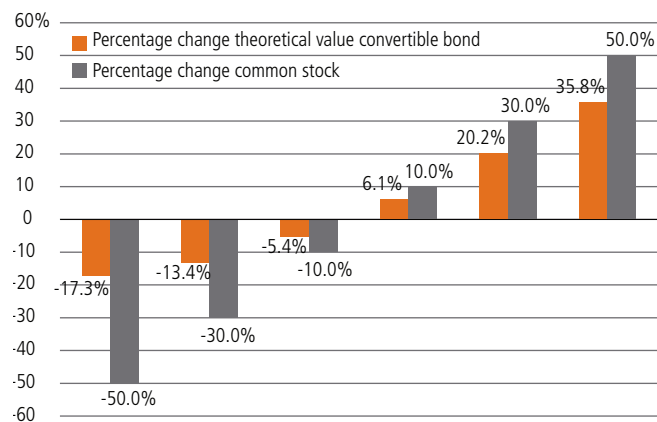
1995. The right-hand pillar gives the corresponding sector weights of the MSCI World Equity Index as a reference (as of 12/31/2006). A development worth mentioning is the rise and fall of the share of convertible bonds representing the telecommunication sector over the last several years, coinciding with the Technology, Media and Telecom (TMT) bubble.

2. Basic attractions of convertible bonds

Convertible bonds are hybrid instruments that simultaneously offer the potential upside of equities (generally unlimited), while providing a limited downside in the form of a bond floor. This means that a balanced convertible bond will offer an asymmetrical payoff profile that gives investors a higher participation in upward movements in the underlying as opposed to downward movements in the underlying. Expressed somewhat more technically, convertible bond prices are convex with respect to the price of the underlying.⁴

The asymmetry of payoffs is by no means negligible. Exhibit 3 gives an impression of the magnitude of this effect for the Allergan 1.5% 2021 convertible bond.⁵ If for example Allergan common stock would instantly gain 30% in value, investors could expect the Allergan 1.5% 2021 convertible bond to gain 20.2% in value. If the stock was to fall by 30%, convertible bond investors would lose “only” 13.4%.⁶

Exhibit 3: Allergan 1.5% 2021: Change in theoretical value versus change in value of the underlying



Source: UBS AG, MACE Advisors; Bloomberg. Data as of September 1, 2006. For illustrative purposes only.

³ We define a sector as the sector of the potential equity conversion, and not as the sector of the company issuing the bond (e.g., if a financial services company issues a bond that is exchangeable into shares of a telecommunication company, we classify the bond as a telecom issue).

⁴ We refer to convertible bonds as “balanced” if their implied option trades at the money. If the option trades (deep) in the money, the convertible bond behaves similar to the equity it is convertible into. If the option trades (deep) out of the money, the convertible behaves similar to a straight bond.

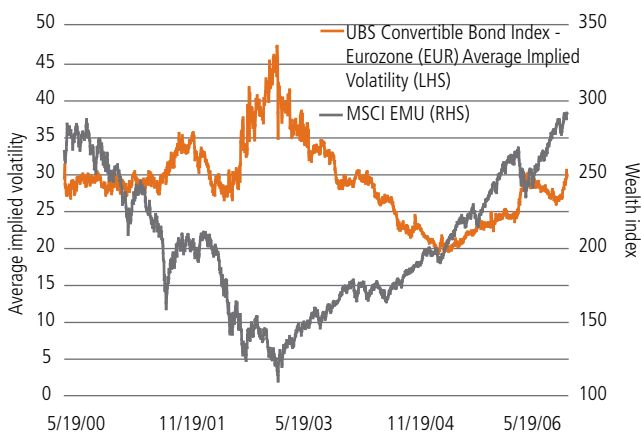
⁵ We use Allergan 1.5% 2021 as an example because it is a balanced convertible bond that shows approximately average convexity, similar to the overall UBS Global Convertible Bond Index.

⁶ For a more detailed analysis of the benefits of convex versus linear or concave investment strategies, see reference [14].

Of course, this intuitively attractive property of convertible bonds comes at a price. While an investor in a convex strategy clearly benefits from large directional movements in the underlying, the strategy will lose if the market either does not move significantly or only oscillates around its starting value.⁷

Another property of convertible bonds that is often quoted as a reason for their continuing attractiveness is their inherent diversification. Since a balanced convertible bond not only offers equity and bond exposure, but also exposure to volatility, it is a better diversifier than a comparable equity and bond mix without any optionality. This diversification benefit is quite pronounced since the level of volatility tends to be inversely correlated with equity and credit market movements, especially in periods of market turmoil. Exhibit 4 shows the pronounced negative correlation between equity market levels and convertible bond implied volatilities. This diversification could clearly also be achieved by adding standard options or variance swaps to a portfolio, but this would not achieve all the convertible bond specific advantages, which will be elaborated below.

Exhibit 4: Equity markets versus convertible bond implied volatility⁸



Source: UBS AG, MACE Advisors.
Data as of December 31, 2006.

While convexity and diversification benefits can reasonably be expected to continue to exist in the future, alone they represent relatively weak arguments to invest in convertible bonds. An investor could achieve similar benefits by adding (equity) options to a mixed equity and bond portfolio. Along this line of reasoning, it is often claimed that convertible bonds could be replicated by some combination of equities, bonds and options. If true, that would mean that convertible bonds are effectively redundant. This redundancy argument often leads to the conclusion that convertible bonds are not, in and of themselves, a true asset class. We dispel this myth below.

3. Why convertible bonds cannot be replicated

Convertible bonds have several features that make it virtually impossible to replicate them through the combination of instruments, such as equities, bonds and options.

3.1. Bond as exchange property

One of the most fundamental differences between a convertible bond and a replicating portfolio consisting of a corporate bond and an equity call option lies in the exchange property (i.e., what exactly can be exchanged into equity shares). In the case of the convertible bond, the holder can obtain a certain amount of underlying shares in exchange for the whole convertible bond structure. In the case of the replicating portfolio containing a bond and an option, the holder of the portfolio has the right to exercise the option to buy shares for a certain predefined (strike) amount of cash.

If conversion of a convertible bond were only possible at maturity, there would be no material economic difference between conversion of a convertible bond and the exercise of an equity option. In both cases, the investor would have to give up a fixed amount of wealth in exchange for the shares. For an option, this amount is defined as the strike, while the value of a bond at maturity is equal to its redemption value. Since conversion is almost always possible prior to maturity, there is a meaningful distinction between convertible bonds and the replicating portfolio. In the case of the convertible, the value of the relevant exchange property at the time of (potential) conversion is not deterministic, but depends on the yield and credit spread level, as the bond would cease to exist once it is converted. Therefore, the economic benefit of conversion does not only depend on the

⁷ For a more detailed analysis of the benefits of convex vs. linear or concave investment strategies, see [14].

⁸ We refer here to the European market, as the longest-running time series of average implied volatilities happens to be available for this particular market (as proxied by the UBS Convertible Bond Index).

equity part of a convertible bond, but also on the value of the bond component that has to be traded in for conversion. That is why the value of a convertible bond depends not only on the value of the bond and the value of the equity option, but also on the interaction between the two.⁹ If one would try to mimic the behaviour of a convertible bond by combining a straight bond with a nonexotic equity option, one would clearly miss this correlation feature. We strongly believe that there are no portfolio strategies using standard building blocks that would replicate this feature.

3.2. Better investor protection in comparison to traditional options

Dividend increases or cash takeovers can have severe negative consequences for investors that hold long call positions on an affected underlying. Increasing a dividend payment can reduce expected future stock prices, and therefore disadvantages investors in call options. Cash takeovers also have the potential to reduce or eliminate the volatility of the underlying, and thus hurt investors in affected options.

In the convertible bond market, some investors faced serious losses following special dividends and cash takeovers. This has been particularly true in the case of hedge funds, the largest single group of convertible bond investors. They tend to delta hedge their convertible bond holdings in order to immunise themselves from movements in the underlying stock. In doing so, they face the potentially detrimental consequences of dividend hikes and cash takeovers, without benefiting from the positive stock price movements that tend to accompany such announcements.

Following these events, there has been plenty of innovation in convertible bond prospectus features that specifically address dividend and takeover risks. Usually, these provisions compensate the holders of bonds for special dividends and cash takeovers by increasing the exchange property if a certain trigger event takes place. Another common form of investor protection in the case of takeovers are so-called “change of control puts.” These give investors an extraordinary put right (often at par) in case a change of control takes place. The latter feature offers protection against the possibility of an acquirer with a substantially worse credit quality.

Since the aforementioned protection features have become standard for new issues in the last years, the proportion of protected bonds in the convertible bond universe is continuously rising. The degree of protection these provisions offer exceeds the protection prevailing for options in the exchange-traded and over-the-counter markets. These built-in protections clearly benefit all types of convertible bond investors, not only hedge fund investors.

Looking at the situation from a fundamental standpoint, one could expect that convertible bonds deserve a lower equilibrium return than options, as the additional protection feature just described makes them less risky than options. Nevertheless, as they are not replicable and cannot be perfectly hedged, their valuation on average does not reflect this feature. Only in rare cases where the takeover probability is perceived as very high does price behavior reflect this difference between instruments.

3.3. Optionality for companies where there is no liquid option market

In some areas of the convertible bond market, it is simply not possible to mimic a convertible bond by buying a bond/option combination because no straight bonds and/or no liquid options are available. This is often the case for illiquid stocks (e.g., small caps) and for stocks that for other reasons may be difficult to short. A lack of stock borrowing and lending hinders efficient hedging of such an option position, making it unattractive for investment banks to issue them, since such a position would bind too much risk capital. As an active convertible bond manager, one can benefit from these opportunities, taking the role of liquidity provider for these nonhedgeable instruments.

From the discussion above, it should be quite clear that replication strategies for convertible bonds are bound to miss important structural features of the convertible bond market.

4. Why convertibles tend to trade cheaply

Another characteristic of the convertible bond market that makes it attractive is its tendency to offer investors the opportunity to buy volatility exposure at a relatively cheap price.¹⁰ This is the fundamental reason why hedge funds play

⁹ This interaction is especially hard to capture for dual currency bonds. Such bonds are issued in one currency and can be exchanged into shares that trade in another currency. An example of that kind of bond is Roche 0% 2021. This US dollar-denominated bond can be exchanged into Roche shares that trade in Swiss francs.

¹⁰ For recent empirical studies on convertible bond cheapness, see references [8] and [9]. Both papers find that cheapness is more pronounced for convertible bonds that trade “out the money.”

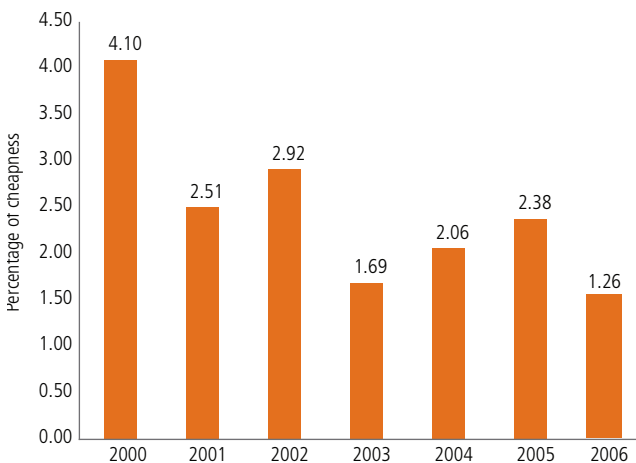
such an important role in the convertible bond market: They try to exploit the cheapness of convertible bond implied volatilities.

We see three major reasons why convertible bond implied volatilities represent a good bargain for investors. First, convertible bonds are often issued cheap relative to theoretical value. Second, issuers have a tendency to make suboptimal use of their call rights. And third, for some convertible bonds, high borrowing fees on the underlying make convertible bond exposure for outright investors attractive.¹¹

4.1 Cheap issuance

One of the most important features of the convertible bond market is its primary market behaviour. Empirical evidence demonstrates that on average, convertible bonds are issued cheap.¹² Exhibit 5 gives an impression on new issue cheapness for the US.¹³ Anecdotal evidence points to similar new issue cheapness in Europe and even more so in Asia. In this respect, it is interesting to refer back to Exhibit 1 which shows that the amount of new issuance has been material over the years.

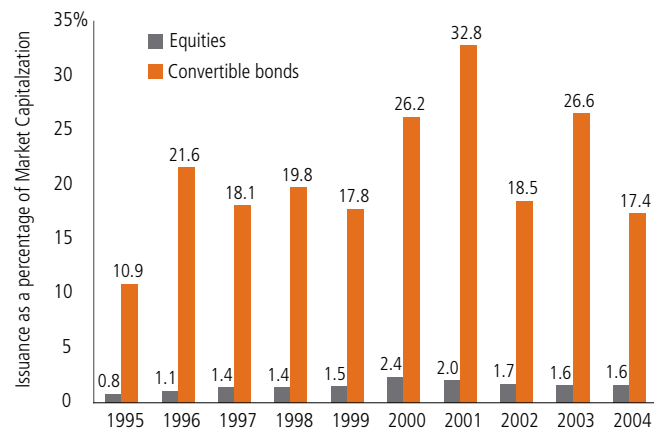
Exhibit 5: Average cheapness of US convertible bond new issues



Source: Lehman Brothers.
Data as of December 31, 2006.

While the empirical evidence for convertible bond new issue cheapness is strong, the theoretical reason for the cheapness is less clearcut. One argument why convertibles are issued cheap says that issuers and underwriters are willing to accept some new issue cheapness as a form of insurance premium to make sure that a deal can be launched successfully. By doing this, they try to avoid the liquidity and reputation costs that a failed deal may induce (which can raise the cost of capital for the issuing entity). Undoubtedly, this argument also holds for the issuance of other instruments like common equity. The reason why this phenomenon is more material for the convertible bond market than for other markets is the much higher ratio of new issuance to total outstanding market capitalization within the convertible bond field. Exhibit 6 gives an impression of the importance of new issuance for the convertible bond market.

Exhibit 6: New issuance as a percentage of market capitalization



Source: SDC, DataStream, Lehman Brothers, MACE Advisors, UBS AG.
Data as of December 31, 2005.

¹¹ We refer to investors that hold convertible bonds without engaging in hedging transactions as “outright investors.” They contrast to hedged investors that partially or totally hedge out risks inherent in their convertible positions.

¹² For recent empirical studies on convertible bond new issue cheapness, see references [10] and [12].

¹³ We refer to new issue cheapness as the difference between the new issue price of a convertible bond and the respective theoretical value, expressed as a percentage of the issue price. In cases where there are no straight bonds and/or no equity options available for comparison, one has to use somewhat subjective assumptions concerning appropriate spread and volatility levels in valuing the bond. Since the level of new issue cheapness is substantial and cases where no comparisons are available tend to be the exception, we are confident that these findings are not driven by using inappropriate assumptions in the valuation process.

A second reason cited for new issue cheapness is that in certain instances the convertible bond market acts as a funding source of last resort for companies whose ability to issue new straight bonds or equity is seriously limited. Convertible bond markets are offering funds to such issuers because hedged investors are able to create portfolios that are basically immunized from movements in credit and equity of the underlying. Typically, this is done by buying convertible bonds and simultaneously shorting stock and buying credit default swaps. Therefore, if a new deal is priced attractively enough, “hedged investors” will buy a new deal just to exploit the cheapness. Along these lines of reasoning, new issue cheapness can be seen as a function of an issuer’s need to attract hedged investors to a deal.

Another argument concerning new issue cheapness starts with the observation that issuers of convertible bonds monetize the volatility of their own shares. This implies that they are selling something that they otherwise may not be able to sell. Therefore, the opportunity costs of not selling a convertible bond far outweigh the potential benefits of a slightly higher price. In such a setting it seems reasonable that issuers tend not to be too price sensitive.

A further point worth keeping in mind is that when a company does a new equity placement, this always happens at a discount to the current market price. This is something a treasurer clearly has in mind when comparing alternative financing possibilities. In the case of a stock placement, existing shareholders usually get a subscription right, which gives the discount back to them. In the case of a convertible placement, the discount is received by the party that buys the new bonds (usually the biggest convertible bond managers).

Finally, tax and regulatory considerations have to be taken into account when discussing convertible bond new issue pricing. There are examples of convertible bond issues that are very equity-like, but are structured as a bond. For issuers, this has the advantage of combining the economic and regulatory benefits of equity issuance with the tax shelter that coupon payments offer, as coupons are paid before tax while dividends are paid after tax. Again, it is conceivable that this proposition is so attractive to issuers that their price sensitivity is somewhat curbed.

To conclude, for a treasurer it is always convenient to be in a situation where she can sell the proverbial glass as being “half full” in all scenarios: If equity markets rise, the issued convertible bonds will get converted and she has basically

sold stock at a premium compared to the stock level at issuance. If that does not happen, the company has benefited from cheap debt. So from this perspective the only possible blame would be if a deal goes really badly. Who would not be on the cautious side when fixing a new issue’s terms with the above in mind?

4.2. “Suboptimal” call exercise

Call features are a very common prospectus clause for convertible bonds. They give the issuer the right to call a convertible bond at a fixed price (often at par). In many cases the call right is time dependent (e.g., a bond becomes callable three years after issuance) or conditional on the performance of the underlying (e.g., the bond becomes callable if the underlying trades above a certain trigger level—a so-called “soft-call feature”). Usually, if the issuer decides to call a bond, the holder of the bond has the opportunity to convert the bond between the announcement date of the call and the call date. The investor will prefer conversion as long as parity (i.e., the value of shares to be received upon conversion) exceeds the call price. This has two implications: First, an investor faced with an issuer call will usually wait until the last day possible to decide whether to convert in order to avoid a decision that becomes uneconomic due to market movements. Secondly, if an issuer calls a bond that is deep in the money, the issuer can usually expect the holders of the bonds to convert. In that case, the issuer call is simply a means to force conversion.

From an issuer perspective, forcing conversion by calling a convertible bond can go terribly wrong. The case of VNU, the Dutch publishing company, shows the potential problems. On February 26, 2001, VNU announced its intention to call its 2.75% 2005 convertible bond at 100% with effective date April 17, 2001, which was the first day on which this bond was callable. On the announcement date, parity of the bond stood at 117.80%, which indicated a very high probability that bondholders would choose to convert their bonds. Most unluckily for VNU, its share price fell in the weeks after the announcement by more than 20%. On April 4, 2001, the last day bondholders could convert their bonds, parity was down to 92.50%. Logically consistent, nearly all bondholders chose not to convert. VNU therefore was confronted with an unanticipated cash outflow of about EUR 340,000,000. To generate the necessary liquidity, VNU chose to issue a new convertible bond.

Given the potential unintended consequences of calling a convertible bond, it comes as no surprise that issuers do not

always handle calls in a theoretically rational fashion. Theoretically, a rational issuer will call a bond as soon as it is economically beneficial to do so, i.e., if the call price is less than the current convertible bond value without a call. Due to their limited access to liquidity, that is often not the way issuers behave in practice. In order to avoid unintended outcomes of a call, issuers tend to call a bond only if the current convertible bond price comfortably exceeds the call price.

The flipside of this alleged “irrational” behaviour of issuers is some “free” implicit call protection that increases the value of a convertible bond to investors. The value of this additional call protection can be seen by including some “call cushion” into fair value calculations. In practice, this is of limited help since such a procedure is highly sensitive to the level of the call cushion (which relies on somewhat arbitrary assumptions).

4.3. Benefits of high borrow cost

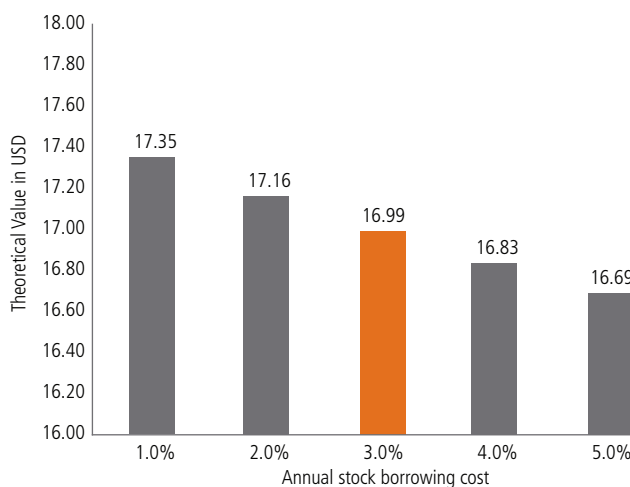
Somewhat surprisingly, outright convertible bond investors can profit from high lending fees on the stocks that underlie their bonds. The reason for this is that the marginal, price-setting investor in the convertible bond market is usually a hedged investor. Since these investors have to short the underlying, the costs of shorting (stock lending fees) will be reflected in the price they assign to a bond.¹⁴ Since a higher lending fee on the underlying makes a short position more expensive to hold, a higher lending fee also implies a lower theoretical value of a convertible bond.

Since outright investors do not short the underlying, they do not face the hedging costs. Therefore, a high lending fee can offer outright investors an additional source of return that materializes when the cost of shorting declines. This can happen via a sudden drop in the lending rate or simply by the passage of time. As time to maturity declines, so does the absolute cost of holding a short position in the underlying shares.

The implicit accrual of lending fees via an outright convertible bond holding can be significant. Exhibit 7 shows the theoretical value of General Motors \$6.25 2033 convertible preferred stock for different levels of lending fees, assuming all other factors stay unchanged. Due to heavy short position-

ing, the stock borrowing cost for GM shares is currently quite expensive at around 300 basis points per year.¹⁵ A reduction of that fee to 100 basis points per year would increase the theoretical value of this security by around 2%. Should borrowing costs remain unchanged, an outright convertible bond investor could still profit by earning a relatively higher yield to maturity.

Exhibit 7: Theoretical value of General Motors \$6.25 2033 for various levels of lending fees



Source: Bloomberg.
Data as of December 31, 2006.

The potential to profit from cheaply priced convertible bonds adds an additional dimension to the portfolio management decision-making process. Obviously, convertible bond selection should not only rely on equity, credit and asset allocation views, but also on a thorough understanding and modelling of each bond's specific prospectus clauses and volatility influences. This additional dimension offers active portfolio managers additional space to seek to add value. These issues, in connection with the important role that new issues play in the convertible bond market, are the fundamental reasons why passive portfolio management is practically non-existent in the convertible bond market.

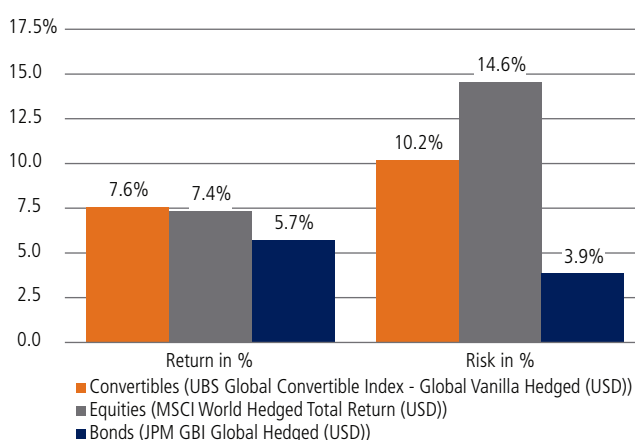
¹⁴ Convertible bond valuation tools capture this market behaviour by incorporating lending fees in the valuation process. This makes intuitive sense since it is necessary to short shares to extract any theoretical misvaluation, or to run a hedged position on a book.

¹⁵ As of December 31, 2005.

5. Historical risk/return characteristics of the convertible bond market

Now that we have demonstrated the attractiveness (and particularities) of the convertible bond market, let us turn to its historical risk and return. Exhibit 8 shows the historical risk and return characteristics of global convertible bonds, equities, and traditional bonds. In order to minimize distortions caused by currency, we use indices that are hedged into USD. Risk is defined as annualized standard deviation.¹⁶ We focus on a time frame starting on December 31, 1993, since this is the inception date for the UBS Global Convertible Bond Index data series.¹⁷

Exhibit 8: Risk/return 1994 - 2006



Source: DataStream, own calculations.¹⁸
Data as of December 31, 2006.

Exhibit 8 shows in an impressive way how attractive the risk/return relationship of convertible bonds has been in the past. Convertibles have exhibited the highest return with a moderate level of volatility. Similar risk/reward features are apparent in numerous studies of this subject.¹⁹ This is true for most time frames, irrespective of the region, and for different convertible bond indices.

Conclusion

Given the particularities of convertible bonds, it seems clear to us that the risk/return properties of convertible bonds cannot be replicated by combining equities, bonds and options. There is a tendency for convertible bonds to offer cheap volatility exposure. Even if a convertible bond trades too "cheap" during its whole life, it should always approach fair value at maturity since at that point, only the stock price level determines its value. Therefore, outright investments in convertible bonds can extract convertible cheapness over time.

This, in our view, is the basis for the attractive risk/return relationship convertible bonds have exhibited in the past, and why we expect (for the reasons elaborated above) this attractiveness to continue into the future. Therefore, we think allocating to convertible bonds within a diversified portfolio is a pragmatic and valuable investment decision that allows the investor not only to gain convexity and diversification benefits, but also exposure to the attractive risk/return properties of convertible bonds.

¹⁶ Even though the payout of each convertible bond is clearly non normal, the return distribution of the whole market is at least as normal as that of bonds or equities. This is examined in detail in reference [8].

¹⁷ To our knowledge, there are not any convertible bond indices for which a longer time series is available.

¹⁸ MSCI does not publish a time series for the MSCI World that is both total return and hedged. In order to compare apples to apples, we calculated a time series for a synthetic MSCI World Hedged Total Return by adding the monthly excess returns of the MSCI World Total Return Index (USD) over the MSCI World Price Index (USD) to the time series of the MSCI World Hedged (USD).

¹⁹ See for example references [1]–[6] and [13].

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