THE CONVERTIBLE BOND MARKET DISLOCATION OF 2008:
Creating Opportunities in 2009 and Beyond
AQR Capital Management / CNH Partners

This white paper was first published on December 31, 2008 to examine the likely causes and circumstances surrounding the convertible bond market dislocation which had culminated in the fourth quarter. This update examines whether the opportunity still exists to profit from it.

Recent Outperformance: Year-to-date through June 30, the AQR/CNH Convertible Arbitrage Fund returned approximately 28% net of fees while the HFRX Convertible Arbitrage Index and the Merrill Lynch long-only All Convertibles Index were up approximately 20% and 21% respectively.

“Second Wave” of Cheapness: Convertible bonds may present a second historic investment opportunity as cheapness has once again spiked near the peak reached in the fourth quarter, as measured by AQR / CNH proprietary database tracking 23 years of convertible bond prices and terms.

Still High Expected Returns: We think investors can reasonably expect total gross returns of approximately 18% per year assuming two years to convergence in a levered arbitrage strategy, with low correlation to broad equity and credit markets. Given current cheapness, an un-levered or long-only approach may also be attractive to investors.

Convert Dislocation: Investors substantially de-levered their convertible bond positions in late 2008 in response to 1) a difficult financing environment with increased margin requirements by prime brokers; 2) fund closures, including liquidations by Wall Street proprietary trading desks and investment funds (long-only and hedge funds) facing redemptions; and 3) general risk aversion and low appetite for illiquid securities.

Positive Market Outlook: Following the entrance of new crossover (long-only) buyers and a substantially improved financing environment among levered (hedge fund) investors in the first half of 2009, the convertible bond space witnessed a significant return of supply. Companies have once again returned to the convertible bond market as a source of capital, with global issuance up four-fold in the first quarter, thus keeping convertible bond prices attractive. Looking forward, we expect continued robust levels of new issuance will prolong the period under which convertible bonds are issued at steep discounts, but that continued interest in convertibles among investors will ultimately compress these discounts over the next 1 to 2 years. We feel the historic opportunity remains for investors to capture convertible bond cheapness following the dislocation of 2008.

1 Expected or forecasted returns are no guarantee of future performance and are based on our internal analysis. Investors should realize that when investing one could lose the full balance of their account. Please read important disclosures on the last page of this document.
Introduction

This white paper was first published on December 31, 2008 to examine the likely causes and circumstances surrounding the convertible bond market dislocation which had culminated in the fourth quarter. The size and scope of the sell-off was extraordinary and led to significant losses for many convertible arbitrage investors before year-end. However, this paper also argued that the dislocation likely created a historic investment opportunity for long term investors who could purchase convertible bonds at the steepest discounts to fair value in our 23 years of recorded history. Indeed, many convertible bond investors realized significantly positive returns in the first half of 2009 following on the heels of the massive market dislocation of 2008.

Looking ahead, the question many investors may have today following a period of strong performance is whether the extraordinary convertible bond investment opportunity has passed. While recent positive performance does give an indication that at least some of the upside potential has already been captured by current investors, we believe the best indicator of the future opportunity is our standard measure of convertible bond cheapness – the same measure we illustrated in past versions of this paper to suggest that convertible bonds were historically attractive. Looking at this measure of convertible bond cheapness (chart page 5), we can see a “second wave” of cheapness created in the second quarter due to a flood of new issuance from companies seeking capital from the convertible bond market. The significant increase in supply was not offset by an immediate increase in demand. As a result, the equilibrium prices of convertible bonds fell, causing the cheapness measure to increase. We think new issuance will remain robust for the immediate future as companies seek to increase their liquidity, but that ultimately the entrance of more convertible bond investors and a decreasing rate of issuance will lead to a subsequent period of price appreciation. While it is difficult to predict the likely time horizon for convertible bonds to once again richen, we expect that convertible bond discounts will ultimately converge over the next 1 to 2 years. Therefore, we believe that currently the convertible bond market offers investors a historic opportunity to realize significant returns second only to the peak of convertible bond cheapness realized at the end of the fourth quarter.

- Year-to-date through June 30, the AQR/CNH convertible arbitrage fund returned approximately 28%, net of fees while the HFRX Convertible Arbitrage Index returned approximately 20%.
- Investors benefitted from individual convertible bonds’ realizing lower defaults than implied by their market prices or through bonds extinguishing at higher valuations.
- Cheapness, as measured by the median discount to theoretical value for the equity-sensitive universe of convertible bonds, decreased from its peak of 11% in the 4th quarter of 2008 to 9% as of June 30, a historically high level.
- We can see a “second wave” of cheapness created in the second quarter due to a flood of new issuance from companies seeking capital from the convertible bond market, thereby depressing bond prices.
- After no new issues during the fourth quarter of 2008, about $16 billion was brought to market through new issuances so far in 20091. We expect a robust new-issue market for the second half of 2009 especially during the fourth quarter.
- The re-opening of the new issue market should greatly reduce corporate re-financing risk associated with maturities and puts of existing bonds.

1 Source: AQR
TABLE OF CONTENTS

I. Current Convertible Bond Market Valuation

II. Capturing Convertible Bond Cheapness

III. AQR/CNH Convertible Bond Strategy

IV. Appendix - Introduction to Convertible Bond Investing
I. Current Convertible Bonds Market Valuation

Market Conditions
The convertible bond market experienced a historic dislocation in the second half of 2008 that caused bonds to sell at the greatest discount to fundamental value in our 23 years of recorded history. Convertible arbitrage hedge funds and proprietary trading desks on Wall Street realized enormous losses to their portfolios in the fourth quarter, adding to substantial losses realized earlier in the year. These losses stemmed from the massive deleveraging taking place in the financial system. According to the HFRX investable hedge fund index, the average convertible arbitrage fund was down approximately 58% in 2008. Since proprietary trading desks and convertible arbitrage hedge funds have typically held the majority of convertible bond issues, the market experienced unprecedented price pressure as many of these players lost sources of financing and became forced sellers. The massive de-leveraging peaked in the fourth quarter and accelerated price declines due to a dearth of buyers.

However, so far in 2009, there has been significant improvement in the health of the convertible market following improved financing conditions among levered (hedge fund) investors and the entrance of new cross-over (long only) buyers. Moreover, the attractiveness of the convertible bond market to issuers themselves has significantly improved. Whereas late in the fourth quarter and early in the first quarter many corporate issuers of convertible bonds had been buying back their own bonds because they were trading at such steep discounts to fundamental value, recently there has been a flood of new issuance as companies can issue convertibles at more attractive yields than other sources of capital. Moreover, general re-financing and related default risk have also declined as convertible bond debt can once again be “rolled” forward given investor willingness to hold paper.

Throughout the first half of 2009, the convertible bond financing environment strengthened as prime brokers who had become unwilling or unable to provide leverage to hedge fund clients in the fourth quarter have once again selectively expanded financing. Furthermore, while the financing environment has improved, new unlevered buyers have been purchasing bonds, thereby reducing the aggregate leverage in the convertible bond market, creating what we believe is a healthier market that is less prone to de-leveraging shocks. In addition, we expect this higher ratio of un-levered investors to remain relatively stable in the short-term given that a high amount of leverage is not necessary to build an arbitrage portfolio with compelling expected returns.

Current Opportunity
To measure the attractiveness of the opportunity, we examine the discount or “cheapness” of current convertible bond prices to their implied fundamental values. To do so, we evaluate convertible bonds on a bond-by-bond basis through time. For valuation purposes, the necessary inputs are the terms associated with the convertible bond, the issuer’s stock price, the expected volatility of the issuer’s stock, the credit spread associated with the convertible bond, and the term structure of interest rates. We have a proprietary dataset of U.S. convertible bonds of publicly-traded issuers dating back to 1985 containing more than 1 million data points, and we use this dataset to measure the historical attractiveness of convertible bonds. To mitigate the impact of outliers, we focus on the median discount of price-to-fundamental value. We also limit the analysis to convertible bonds where the underlying stock price is at least 65% of the bond’s conversion price, since focusing on these equity-sensitive bonds mitigates errors associated with inaccurate credit spread assumptions (credit spread assumptions are more important for bonds with deep out-of-the money conversion options since these bonds trade more like distressed debt).
The graph below illustrates the time series trend of the median discount of market value to fundamental value. Convertibles cheapened considerably in 1998 and in 2005. While we did not manage a convertible arbitrage portfolio in 1998, several leading convertible arbitrage indices reported high returns in 1999. Subsequent to convertible bonds cheapening in the second half of 2005, our Fund realized gross returns of approximately 33% over the following 12 months in 2006.

* This represents the median cheapness of the universe of convertible bonds that have a moneyness of above 0.65
Source: AQR Proprietary Models. Data updated through 06/30/2009. Theoretical values are hypothetical in nature. Please see important disclosures on the last page.

Today, convertible bond cheapness far exceeds that of prior periods. From a statistical basis, convertible bonds are approximately 3 standard deviations cheap relative to the historical distribution measured from January 1995 – June 2009. This is too drastic to be explained by statistics alone, and instead requires an understanding of the events which cumulatively resulted in the extreme cheapening.

When many investors are forced to de-lever their positions to meet margin requirements or investor redemption requests, a market which normally operates within one set of bounds may quickly alter all market players’ perceptions if certain expectations are violated. In this market dislocation, the assumption violated was that convertible bond investors could act independently and would step in to purchase assets when priced below fundamental value. Because of financing constraints, that decidedly was not the case in 2008 and, as a direct result, the forward-looking opportunity improved dramatically. At the current level of cheapness, convertible bonds remain one of the most attractive arbitrage opportunities we have ever seen, despite moderate increases in bond prices relative to fundamental value. While convertibles have richened from their maximum level of cheapness reached in the fourth quarter of 2008, they have actually cheapened once again nearly to the peak level reached in the fourth quarter as there has been a flood of new issuance without a commensurate increase in demand. This new issuance has created what is in our opinion a “second wave” of opportunity for convertible investors to buy bonds near their peak cheapness. Of course, convertible bonds may once again cheapen to or beyond the recent peak in the short term. However, at extinguishment of a convertible bond (maturity, call, default, etc.), cheapness will collapse to zero and investors should be rewarded for holding a portfolio of bonds purchased below fundamental value, barring any new extreme moves in other important determinants of value such as the portfolio’s average default rate (see Section III: “Strategy Risks”).
II. Capturing Convertible Bond Cheapness

Investors may seek to capture convertible bond cheapness in an un-hedged long-only convertible bond portfolio, or in a convertible arbitrage strategy which seeks to hedge unwanted risks from the portfolio. Both approaches may benefit when convertible bond cheapness converges, but the two methodologies will be more or less appropriate for specific investors based on existing asset allocations, desired beta exposures and risk tolerances. Convertible arbitrage strategies may be better suited for investors that have already reached their targeted allocation to equity, credit and interest rate betas. Additionally, the risk/reward profile for each strategy is significantly different. Based on historical data and AQR/CNH current projections, we forecast an expected gross Sharpe Ratio of 0.8 for our long-only convertible bond strategy versus a 2.5 expected Sharpe Ratio for our convertible arbitrage strategy. Convertible arbitrage can be applied on both a levered and un-levered basis.

Levered Convertible Arbitrage Strategies
Convertible arbitrage strategies are designed to isolate and capture a convertible bond’s discount to its fundamental value. Because convertible bond values have exposure to equity, credit and interest rate betas, a convertible arbitrage strategy seeks to hedge those risks from the portfolio. To do so, shorting techniques and derivatives are employed. Once these risks are hedged and managed appropriately, the portfolio is positioned to primarily capture cheapness as bonds converge to fair value. Because a hedged convertible arbitrage portfolio has lower volatility and expected return than a long-only implementation, leverage may be employed to increase targeted volatility and expected return. However, as convertible bonds are less liquid securities, it is important for the convertible arbitrage manager who employs leverage to secure stable sources of financing, provide appropriate liquidity terms to investors and practice robust risk management to avoid having to sell positions below fundamental value. In fact, convertible arbitrage managers today typically apply less leverage due to increased financing costs, high volatility and the fact that un-levered expected returns are already very attractive. For example, currently the AQR/CNH Convertible Arbitrage Fund employs just over 2x leverage, whereas in earlier low volatility market environments that figure has been meaningfully higher.2

Un-levered Convertible Arbitrage Strategies
For the investor that wishes to avoid financing risk but still would like to hedge equity, credit and interest rate betas, convertible arbitrage can be implemented on an un-levered basis. Historically this has not been very attractive to investors, given the low volatility and tight spreads typically found in convertible arbitrage. Today however, convertible bonds are trading at historic discounts to fundamental value, such that even on an un-levered basis, we feel the strategy may have significant upside. In short, the current environment represents an unprecedented opportunity for leverage-averse investors to pursue convertible arbitrage, with its significant diversification benefits and lack of correlation, yet with potential for attractive returns over the next 1 to 2 years.

Long-Only Convertible Bond Strategies
A long-only convertible bond strategy seeks to capture a convertible bond’s discount to its fundamental value without hedging equity, credit and interest rate risk. Therefore, the long-only convertible bond portfolio’s value will fluctuate with changes in these underlying factors which may substantially increase or decrease realized returns. Long-only convertible strategies may be more appropriate for investors who wish to increase their allocation to these risk factors in addition to capturing convergence of convertible bond cheapness. For example, an investor who believes that either credit or equity markets are currently undervalued may make a tactical decision to hold convertible bonds in a long-only portfolio to both gain exposure to the convertible bond market’s historic cheapness as well as the directional bet on the broader markets.

2 Leverage defined as Long Market Value / Net Asset Value
III. AQR/CNH Convertible Bond Strategy

AQR/CNH Convertible Arbitrage
Led by Mark Mitchell, PhD, and Todd Pulvino, PhD, the AQR/CNH Convertible Arbitrage Fund takes a unique approach based on over a decade of convertible bond research and six years of experience managing the Fund. Based on the proprietary AQR/CNH database which tracks convertible bond terms and prices in the U.S. over the past 23 years, AQR/CNH is uniquely positioned to measure strategy attractiveness, appropriately seek to hedge unwanted risks, and keep transaction costs low while also acting as a liquidity provider to distressed sellers to capture current convertible bond cheapness. AQR also has a decade of firm-level experience managing market neutral absolute return funds and, with approximately $20B under management and 200 employees, AQR/CNH has the back office infrastructure, trading and risk management systems necessary to appropriately manage convertible arbitrage strategies.

Our disciplined and systematic approach to convertible arbitrage is based on constructing a broadly diversified portfolio of individual convertible bonds and explicitly attempting to hedge out unwanted equity, credit and interest rate risk. We are primarily trying to extract a risk premium from the universe through our diversified strategy rather than attempting to hold a concentrated portfolio which would be exposed to idiosyncratic risk from individual positions. However, we do not purchase bonds indiscriminately. Rather, we invest in the most attractive bonds trading at a significant discount to our proprietary pricing model. Given less liquidity and high transaction costs inherent in the convertible bond market, our approach avoids excessive trading. Fundamental analysis is an essential part of the AQR/CNH process as we examine all of the inputs into our model based on financial statement and market data, and we sell out of positions when our analysis suggests they are fully valued.

In order to capture the cheapness of a convertible bond without assuming high equity, credit and interest rate risk, AQR/CNH seeks to hedge those risks out of its Convertible Bond Arbitrage Funds both at the individual security and at the portfolio levels. The first step is to hedge the equity risk by shorting the stock of the underlying convertible bond issuer. The proper ratio of stock to short for each convertible bond is determined by the convertible bond’s equity sensitivity (known as its “Delta”).

To also attempt to hedge interest rate and credit risks out of the portfolio, one must be able to accurately estimate the amount of these residual risk factors in the convertible bond portfolio. To do so, we use our proprietary database of U.S. convertible bonds to estimate interest rate and credit sensitivities. The length and robustness of this database gives us greater confidence that we are, in fact, using the proper hedge ratios to remove these risks from the strategy as much as possible.

Seeking to hedge portfolio risks we trade U.S. Treasury futures (to hedge interest rate risk) and CDX credit default swap indices (to hedge credit risk). Because managing a convertible arbitrage strategy is a dynamic process with constant changes in interest rates, credit spreads, stock prices and convertible bond issues, AQR Capital / CNH Partners analyzes the portfolio continually and adjusts hedges accordingly.

AQR/CNH Convertible Arbitrage Fund Performance
The AQR/CNH Convertible Arbitrage Fund has outperformed the HFRX Convertible Arbitrage investable index (see chart page 8)3. We believe our outperformance is due to our focus on equity-sensitive bonds which have less credit risk, our ability to select the most attractive bonds trading at a discount to their fundamental values, as well as our diversified approach where we seek to fully hedge equity, credit and interest rate risk while keeping transaction costs low.

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3 Through June 30, 2009.
The AQR/CNH Convertible Arbitrage Fund (the “Fund”) currently has a value-weighted average cheapness of approximately 15% with leverage of approximately 2x (we consider this relatively low leverage given that we purchase equity-sensitive bonds which are more easily hedged than credit-sensitive issues). Our forecasted excess-of-cash holding period gross return to the Fund is approximately 30% cumulatively through convergence. This could take as long as 4 years but we expect it will likely take around 2 years. Assuming convergence occurs in 2 years, the annualized expected excess gross return is approximately 15% per year. Of course, if convergence to fair value occurs sooner, the annualized returns will be higher. The annualized expected excess gross return is approximately 8% per year for the un-levered arbitrage version of the Fund, assuming 2 years until convergence.

AQR/CNH Long-Only Convertible Bond Strategy
Although AQR/CNH does not currently manage a long-only convertible bond strategy our approach to long-only convertible bond investing would be the same convertible bond selection methodology used in our AQR/CNH Convertible Arbitrage Fund. All of the security selection insights gained from our proprietary database of convertible bonds over the last 23 years can be employed in the long-only strategy. The primary differences in the long-only implementation are that we do not hedge equity, credit or interest rate risk from the portfolio, and therefore do not use shorting techniques, derivatives or leverage. Additionally, since a long-only convertible bond investor may be explicitly seeking either more credit or equity beta exposure, a long-only portfolio can be constructed to tilt toward equity- or credit-sensitive bonds to customize its risk and return profile.

Whether structured to hold more equity- or credit-sensitive exposure, we believe a long-only convertible bond strategy may provide high, diversifying returns and can be characterized by equity-like upside potential with bond-like downside protection. Because a long-only implementation will not hedge equity risk exposure, investors can increase their equity exposure by holding convertible bonds, which may be desirable either as an efficient way to gain this exposure or to make a tactical bet that equities are undervalued after recent market declines. Similarly, for investors of a highly diversified portfolio of low-money convertible bonds, the recent dislocation in the convertible market provides a tactical opportunity to obtain credit exposure at a large discount. As a result of the uniquely stressed conditions in the convertible market versus the high yield and investment grade markets, it is AQR/CNH’s belief that out-of-the-money convertible

* Please note that AQR does not currently trade the Long-Only Convertible Bond strategy described herein
bonds represent a superior way to invest in the corporate credit market. It is important to note, however, that this strategy should not be viewed as an absolute substitute to holding “cheap” straight corporate debt. Instead, we believe it can be viewed as a superior but complementary component of a diversified fixed income portfolio. Because of the diversification gained from holding bonds of different issuers and because of the current cheapness in the convertible bond market, including out-of-the-money convertible bonds in a corporate bond portfolio will currently increase the portfolio’s expected Sharpe Ratio.

For the long-only investor who seeks to capture current cheapness, the objective is to hold a portfolio of bonds until they richen, either in the secondary market or through corporate actions. Given the terms of the current bonds in the market, we estimate that the value-weighted average expected life of the securities in a diversified portfolio of bonds is roughly three years. However, it is unlikely that bonds will continue to trade at current cheapness levels for the remainder of their expected lives. We will be surprised if it takes more than two years for the market to return to a more normal environment in which bonds trade near their fundamental values.
Strategy Risks
The primary risk to convertible bond investing is that short-run losses can arise if the convertible bond becomes even cheaper, a problem exacerbated by any forced liquidation, which is a greater risk in levered portfolios. Past history has demonstrated the outcome of forced liquidation by funds engaging in convertible arbitrage. In 1998 when hedge fund Long-Term Capital Management (“LTCM”) experienced large losses on macroeconomic bets, it was forced to liquidate investments across markets, even those in which fundamentals had not changed. LTCM’s liquidation of its convertible arbitrage portfolio caused bond prices to decline, which in turn caused other hedge funds to sell their convertible holdings. A similar situation occurred in 2005 when some investors began to withdraw capital, and to meet these redemptions, hedge funds began to sell convertible bonds, causing their prices to fall further relative to fundamental values. This led to a subsequent wave of selling and price devaluation. In both cases, it took several months before bond prices returned to more normal levels and equilibrium was restored. Although convertibles may become cheaper before converging to fair value, this is a characteristic which is not unique to convertible bonds and generally not a great concern for longer term investors either in long-only convertible bond strategies or convertible arbitrage as long as the amount of leverage is appropriate for the hedged strategy and financing is secure.

Risks that could undermine current convertible bond cheapness are of primary concern for investors since these lead to realized losses. A deteriorating average credit rating is a primary risk of convertible bond investing since it may indicate an increase in likely bond defaults. Using our current Fund holdings, we calculated the change in the portfolio’s average credit spread that would be needed to eliminate any positive expected return in the Fund. The result of our stress test is that credit spreads would have to increase from approximately 840 bps to 1,800 bps, using the conservative assumption that volatility and equity prices are held constant. However, holding volatility and equity prices constant for a credit spread change of this magnitude is not a realistic assumption in our opinion and experience. For example, volatility is positively correlated with credit spreads, and thus an increase in the spread is usually offset by an increase in volatility which is beneficial to convertible bond values. Moreover, using the same conservative assumption that other portfolio variables are held constant, the result of our bond default rate stress test implies that in order to realize losses our average portfolio default rate would have to increase from below 5% to over 32% (assuming 20% historical recovery rates from defaulted bonds). To put this in context, the peak default rate reached during the Great Depression was 15.4%. The third important stress test we performed while holding other variables constant showed that average underlying equity volatility would have to decrease from the current approximate level of 79% to 33% in order to realize losses. We believe this is a conservative test, since it would be a seismic shift to occur without an offsetting benefit from equity prices rising or credit spreads tightening, both of which we would expect to see in an environment of decreasing volatility that is generally an indication of declining market risk and positive sentiment.

In summary, below is a summary of average market input changes necessary to eliminate any positive expected excess return from the Fund while conservatively holding other inputs constant:

1. Average portfolio credit spreads more than double from approximately 840 bps to 1,800 bps
2. Average portfolio convertible bond defaults increase from below 5% to 32% assuming 20% historical recovery rates from defaulted bonds
3. Average underlying equity volatility decreases from current approximate level of 79% to 33%
Conclusion

The convertible bond market dislocation of 2008 created an unprecedented investment opportunity for investors in the first half of 2009. As market participants sold bonds to increase liquidity in the fourth quarter of 2008, convertible bonds reached the cheapest level in AQR/CNH’s 23 year history of recorded market data. Many investors who participated in the market in the first half of 2009 realized significantly positive returns due to the first wave of convertible bond richening as the general financing environment thawed and investor demand for convertibles increased. However, due to a flood of new supply of convertibles there has been a spike in convertible bond discounts to fundamental value, creating what we believe is a second wave of opportunity for investors to realize significant returns as bond prices converge to fundamental value over the next 1-2 years. Of course, convertible bond investments still present risks, some of which are highlighted in “Section III: Strategy Risks.”

Because a convertible bond is a derivative security with fundamental value based on its fixed income and equity conversion option components, cheapness will converge to zero at extinguishment of the bond. To capture that cheapness, investors may choose to hold bonds in a long-only portfolio or seek to hedge equity, credit and interest rate risk using an arbitrage approach. Based on the proprietary AQR/CNH database which tracks convertible bond terms and prices in the U.S. over the past 23 years and live experience investing in convertible bonds since 2003, AQR/CNH is uniquely positioned to build an efficient portfolio of attractively-priced convertible bonds.
IV. Appendix - Introduction to Convertible Bond Investing

High-risk firms often choose to raise capital by issuing convertible securities, which is a way for them to “monetize” the volatility of their equity. To entice buyers to provide liquidity to issuing firms, convertible bonds are often issued at prices below their fundamental values. Post issuance, convertibles are less liquid and thus often continue to trade at small discounts to fundamental values. The size of the convertible bond market is significant at approximately $200 billion in the United States and $350 billion worldwide5.

A convertible bond is a “hybrid” security consisting of a corporate bond that can, at the option of the holder, be converted into shares of common stock. The number of shares into which the bond is converted is called the “conversion ratio.” A related concept is the “conversion price” which is the stock price at which a convertible bond holder is indifferent between redeeming the bond (i.e. receiving par or face value in most cases) and receiving shares of common stock. For example, if a convertible bond has a face value of $1,000 to be paid at maturity, and if the conversion ratio is 50 shares per bond, the convertible bond holder will be indifferent between receiving the $1,000 face value versus 50 shares of common stock when the stock price is $20 ($1,000 par value = 50 shares * $20 stock price). In this example, the conversion price is $20.

Because convertible bonds contain embedded options, these securities exhibit both debt- and equity-like characteristics (see figure below). If the current stock price is near or above the conversion price, the convertible bond will trade more like equity, since it is near or “in the money” and its value is primarily determined by the issuer’s stock price. Likewise, the further the current stock price falls below the conversion price, the more the security will trade like debt because its value will be increasingly dependent on the value of the fixed-income component. In this case, the conversion option is “out of the money.” The value of a convertible bond is the sum of the value of the fixed income component and the option component.

**Convertible Debt**

![Diagram showing Convertible Debt Payoff and Value](source:AQR/CNH. The above chart is for illustrative purposes only.)

**Fixed Income Component Valuation**

The present value of the fixed income component of the convertible bond can be calculated by discounting the coupons and maturity payment using an appropriate discount rate. The discount rate reflects both the general level of interest rates in the economy and the credit risk of the coupons and maturity payment. Credit spread estimates can be obtained from market prices of credit default swaps and non-convertible bonds by the same issuer, or through fundamental analysis (i.e. by examining expected cash flows, assets, and liabilities). When the stock price is well below the bond’s conversion price, the fixed-income component of the convertible bond dominates the option component and the bond is said to be “credit-sensitive.”

5 Source: AQR
Equity Conversion Option Valuation
The value of the convertible bond’s option can be determined by looking at market supplied values of call options on the firm’s stock, or through an equity option pricing model. Though there are several different models that analysts use to value options, such as the Black-Scholes option pricing model, the primary input assumptions for all models are time-to-maturity, stock price, conversion price, risk-free rate of interest, and volatility of the underlying stock. Longer time-to-maturity, greater equity volatility, and higher stock price all increase the option value since it is more likely to be in the money when the bond matures. When there is a high probability that the stock price will be above the conversion price at maturity, the value of the option component of the convertible bond will dominate the value of the fixed-income component. In this case, the bond is said to be “equity-sensitive.”

Putting It All Together – Convertible Bond Value
A convertible bond’s fundamental value is the sum of the values of the fixed income component and the option component. Dividing the fundamental value by the convertible bond market price is a measure of the convertible bond’s “cheapness.” For example, if the fundamental value is estimated to be $120 and the current convertible bond price is $110, the bond is said to be “9% cheap” ($120/$110 – 1).

When convertible bonds trade at “cheap” levels, investors can purchase them and capture the expected convergence of market prices to fundamental values. At the extreme, convergence will occur when the bond: (1) matures, (2) is called by the issuer, (3) is put back to the issuer by the holder, or (4) through other corporate actions (i.e. mergers, defaults, exchange offers). If the investor is willing to bear the equity, credit and interest rate risk of the underlying bond, convertible bond cheapness can be captured simply by buying and holding the convertible bond. If the investor is unwilling to bear the aforementioned risks but still wants to capture the bond’s cheapness, he can engage in convertible bond arbitrage by purchasing the bond and hedging the various risks.

Introduction to Delta Hedging
A simple example will help illustrate how convertible bond Delta hedging of equity beta works. Assume that Convertible Bond Z has a conversion price of $10 and the stock price is currently $8. The bond’s “Delta,” or the sensitivity of its value to changes in the stock price, determines how many shares of stock should be shorted to hedge the total number of shares each bond may be converted into (the bond’s “Conversion Ratio”). Let us assume that Convertible Bond Z has a Conversion Ratio of 1.0, since each bond may be converted into one share of equity, and we estimate Bond Z’s Delta to be 0.5 based on historical observation. In this case we will short 0.5 shares of stock for each Convertible Bond Z we hold (0.5 Delta x 1.0 Conversion Ratio = 0.5 shares). Since the share price is currently $8, we short $4 of stock for each bond we hold.

After putting on this short position, let’s assume the stock price moves to $10 and its Delta moves to 1.0 as the convertible bond is “at the money” since its conversion price = the stock price. From the stock price change we have lost $1 from our short equity position, calculated by multiplying the negative of the increase in the stock price by the original Delta ratio (-$2 * 0.5 = -$1). However, because of the increase in the convertible bond’s “moneyness” due to a stock price move upward toward or above the conversion price, we will make more than $1 from the increase in value of the bond’s equity call option (for simplicity assume we make $1.50 on the convertible bond so we net a profit of $0.50 as the Delta changed to 1.0).

Now we must adjust our Delta hedging ratio such that we are short 1 share of stock (since the convertible bond now has a Delta of 1.0). Let’s assume the stock price then moves back to $8. Now we will make $2 on our short 1 share of stock position as the share price falls $2 and, as the convertible bond moneyness decreases, we lose the same $1.50 we made when the moneyness previously increased. However, we still net another $0.50, a round-trip return of $1.00 as we capture part of Bond Z’s cheapness embedded in its conversion option. Profits from Delta hedging will be higher if portfolio volatility is greater than expected as long as the benefit is not offset by larger losses due to credit spreads widening, and vice versa if portfolio volatility is less than expected.
Summary

The foregoing Appendix is intended to serve as a brief introduction to convertible bonds. In summary, convertible bonds are hybrid securities with both fixed income and equity characteristics, the degree to which depends on how “in the money” the conversion price is to the current stock price.

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Please note that AQR does not currently trade the Long-Only Convertible Bond strategy described herein. There are many risks associated with convertible securities including but not limited to liquidity risk, equity risk, interest rate risk, and credit risk of the underlying bond. The information set forth herein has been provided to you as secondary information and should not be the primary source for any investment or allocation decision. Please obtain the advice of your fiduciary prior to any investment.

Convertible bond securities may be considered illiquid securities, which cannot be sold or disposed of in the ordinary course of business at approximately the prices at which they are valued. Difficulty in selling securities may also result in a loss or may be costly to the portfolio.

Past performance is not an indication of future performance.

Gross performance results do not reflect the deduction of investment advisory fees, which would reduce an investor’s actual return. For example, assume that $1 million is invested in an account with the Firm, and this account achieves a 10% compounded annualized return, gross of fees, for five years. At the end of five years that account would grow to $1,610,510 before the deduction of management fees. Assuming management fees of 1.00% per year are deducted monthly from the account, the value of the account at the end of five years would be $1,532,886 and the annualized rate of return would be 8.92%. For a ten-year period, the ending dollar values before and after fees would be $2,593,742 and $2,349,739, respectively. AQR’s asset based fees may range up to 2.85% of assets under management, and are generally billed monthly or quarterly at the commencement of the calendar month or quarter during which AQR will perform the services to which the fees relate. Performance fees are may equal up to 20% of net realized and unrealized profits each year, after restoration of any losses carried forward from prior years. In addition, AQR funds incur administrative fees and may have a redemption charge of 2% based on gross redemption proceeds may be charged upon early withdrawals. Please refer to the Fund’s Private Offering Memoranda and AQR’s ADV Part II, Schedule F for more information on fees. Consultants supplied with gross results are to use this data in accordance with SEC, CFTC, NFA or the applicable jurisdiction’s guidelines.

Hypothetical results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical results, all of which can adversely affect actual trading results. Hypothetical results are presented for illustrative purposes only.

There is a risk of substantial loss associated with trading commodities, futures, options and leverage. Before investing carefully consider your financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when engaging in leverage, trading futures, commodities and/or granting/writing options one could lose the full balance of their account. It is also possible to lose more than the initial deposit when engaging in leverage, trading futures and/or granting/writing options. All funds committed should be purely risk capital.