Duration

What does duration tell you about bond risk? Not as much as you thought!

Duration. It's a short word, with a simple meaning, but those eight letters cause more confusion in the minds of many investors than almost anything else. In fact, there are many variants of duration: spread duration, Macaulay duration, modified duration, but the most frequently used is the latter, shortened to simply "duration".

So what does duration mean?

The first point to realise is that duration is not the same as maturity. Furthermore, duration does not increase linearly with maturity, so the duration of a 30-year bond IS NOT three times that of a 10-year bond. The only exception to this is for zero coupon bonds where duration and maturity are the same. Currently the duration of the US 10-year is 8.8[1] years and the duration of the 30-year is 19.5[1] years.

Although linked, the different types of duration all have subtly different meanings. For example, Macaulay duration is the weighted average number of years an investor must hold a bond until the present value of the bond's cash flows equals the amount paid for the bond. This is useful for bond managers managing long term liabilities, but it has limited practical use for most investors.

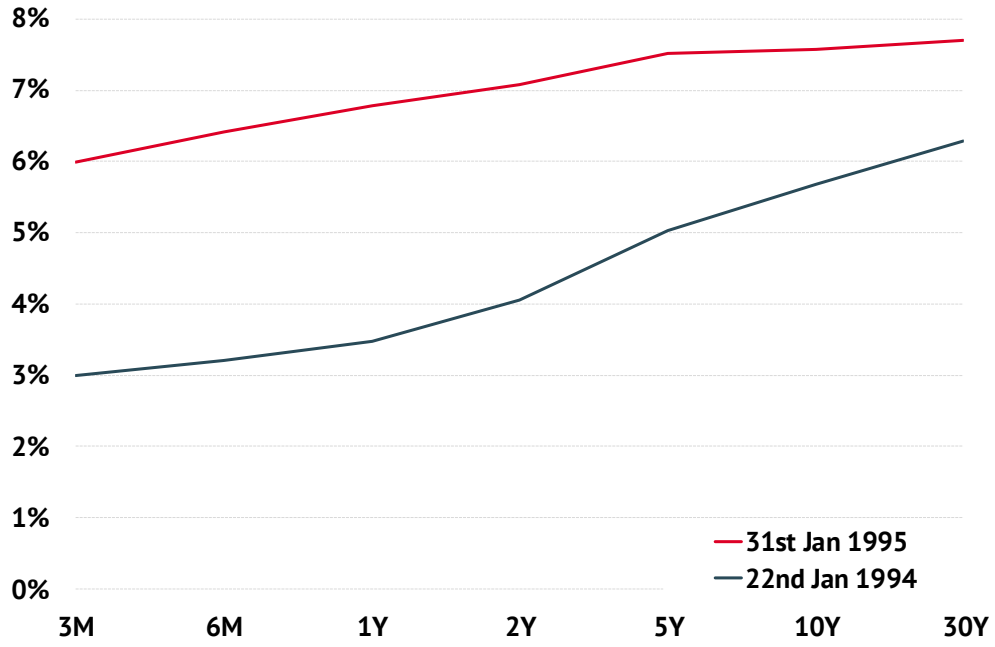
On the other hand, modified duration is useful for both bond managers and investors as this version of duration measures a bond's sensitivity to changes in interest rates. So, for instance, a bond with a duration of three years will gain or lose 3% if interest rates fall or rise by 1%. That's just an approximation though, and strictly speaking the duration concept only works for small changes in interest rates. This note is not intended to be overly technical though, so for our purposes we will assume that a bond with a three-year duration will gain or lose 3% for a 1% change in interest rates.

Where confusion tends to creep in, is the assumption that the change in interest rates refers to a change in short term interest rates. When the press refers to interest rates having risen by 0.25 or 0.5 percent, they are almost certainly referring to the Fed Funds rate in the US or the equivalent base rate in other countries. Very rarely do the words interest rates refer to longer dated bonds in the media. In reality, there are a wide range of interest rates which apply to bonds of maturities up to 30 years or more, but to avoid confusion, in this note we will use interest rates or short rates to refer to short term rates and bond yields for longer dated bonds.

So the first thing to realise is that duration DOES NOT measure the sensitivity of a bond to changes in interest rates, i.e. short term rates. Instead duration refers to the sensitivity of a bond to changes in bonds yields, which is an entirely different concept. Very rarely does the yield of a long dated bond move one-for-one with changes in short term interest rates. To try and illustrate this point, chart 1 (over), shows the change in yields across the maturity spectrum from 3 months to 30 years between Jan 1994 and Jan 1995.

[1] Duration as at 21st March 2017.

Chart 1: US Yield Curve Jan 1994 – Jan 1995

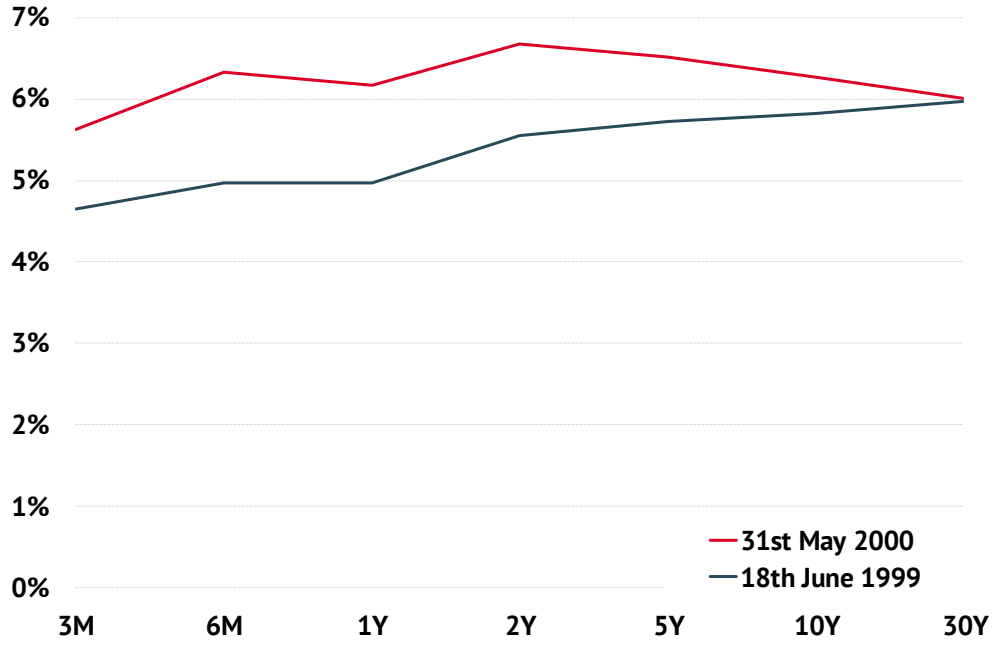


Source: Bloomberg

Notice that whilst short rates moved from 3% to 6%, an increase of 300 basis points (bps), the yield on the 30 year only rose by approximately half that amount. From this we can see that, in this example, the *yield* on the longer dated bond is *less sensitive* to changes in interest rates than shorter dated bonds. Having said that, the longer duration of the 30-year bond results in a greater price movement than is the case from holding shorter dated bonds. This example may reinforce the notion that shorter dated bonds are safer than longer dated bonds during tightening cycles, but this is just one set of possible outcomes.

Chart 2 shows what happened to US Treasury yields in the period between June 1999 and May 2000.

Chart 2: US Yield Curve June 1999 – May 2000

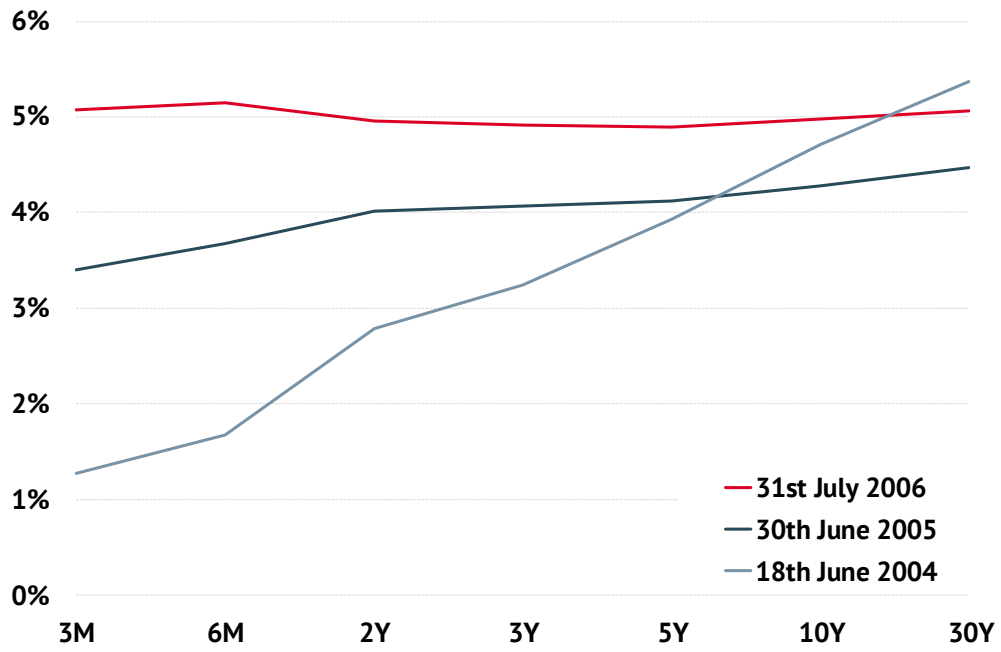


Source: Bloomberg

In this case, interest rates rose by around 1%, the yield on the 2-year rose by slightly more than 1%, whereas the 30-year bond yield was unchanged. The net result was that holders of shorter dated bonds made capital losses, whereas holders of the 30-year did not.

The final chart (3) shows the change in the US yield curve between June 2004 and July 2006. In the first year of that tightening cycle, 3-month short rates rose by a fraction over 200bps, whereas the yield on the 30-year DECLINED by around 100 bps. This result surprises many people, but in fact is the normal course of events for cycles where the Fed is tightening pre-emptively. Under such circumstances, the central bank is actively trying to slow the economy, which reduces inflation expectations and tends to lower yields on longer dated bonds.

Chart 3: US Yield Curve Jun 2004 – Jul 2006



Source: Bloomberg

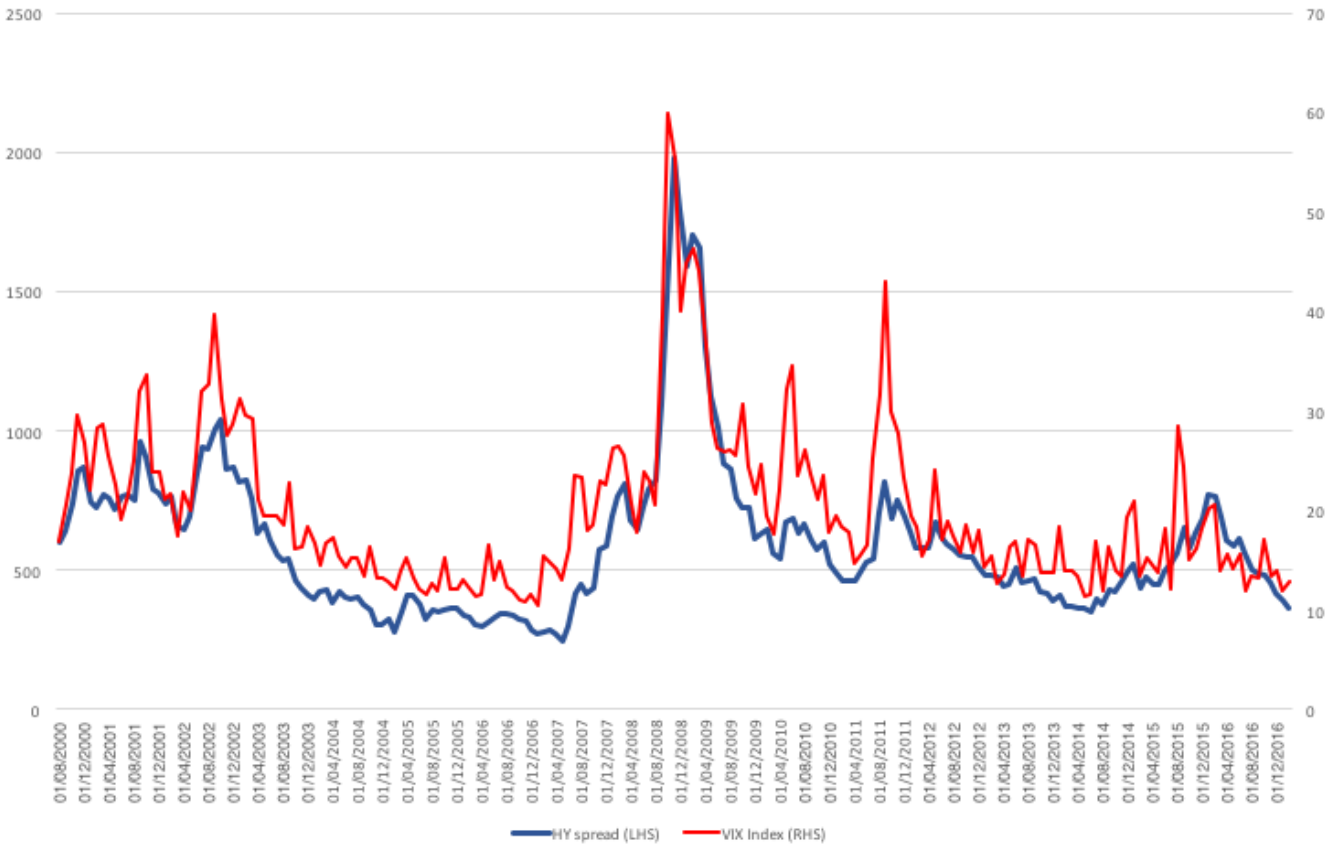
These three examples highlight that during tightening cycles, holders of shorter dated bonds made capital losses in all three cases, whereas the returns from holding longer dated bonds depended on the circumstances at the time.

Credit duration

Things become rather more complicated when one looks at credit markets. Whilst it remains the case that a 3-year duration bond will gain or lose roughly 3% for a 100 basis point move in yields, remember that this does not mean a 100 basis point change in short rates. In fact, whilst a change in short rates may well cause yields on credits to rise, they may also fall, depending on what has been priced in by the market. More importantly, any change in short rates that effects credit spreads will usually impact lower rated bonds by more than higher rated credits.

To understand why, it would be helpful if we replaced short rate changes with uncertainty or volatility. Anything that causes uncertainty, and short rate changes will fall into this category, will result in increased volatility. In turn, changes in volatility are highly correlated with changes in credit spreads as illustrated by chart 4.

Chart 4: HY Credit Spreads and Volatility



Source: Bloomberg

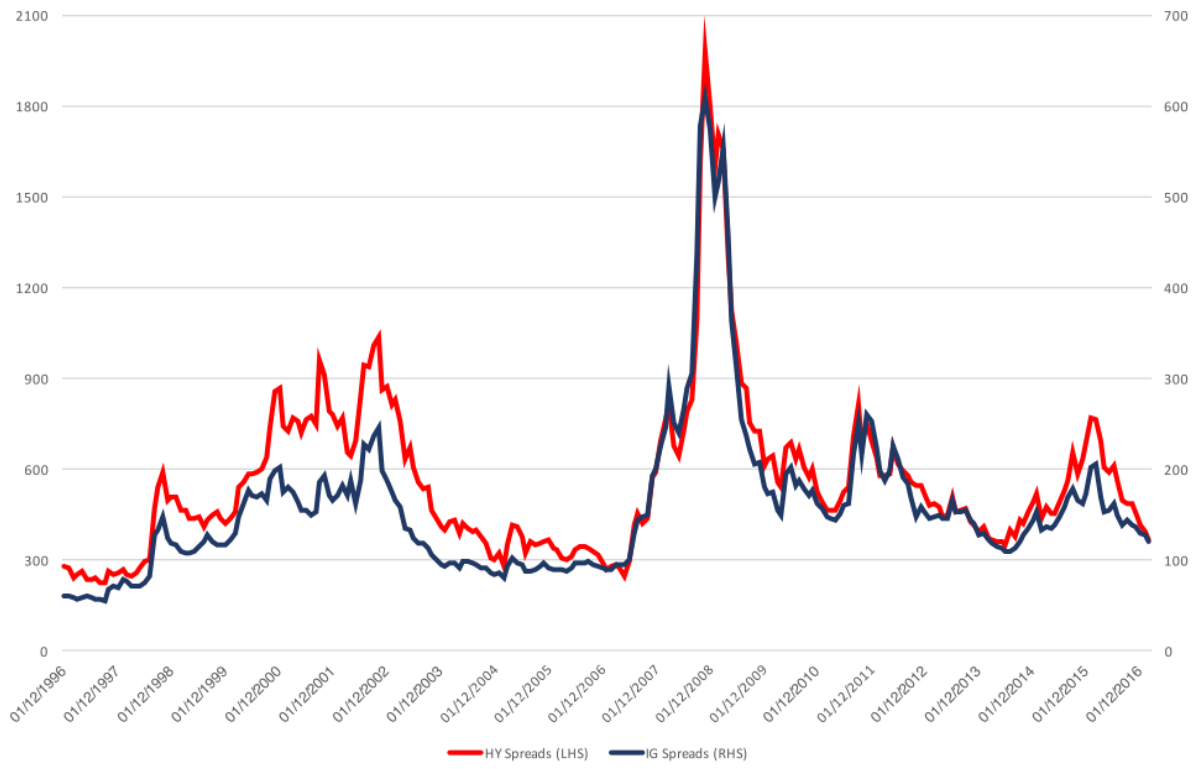
For volatility we have used the VIX index, which measures the implied volatility of options on the S&P 500 Index. What is clear from the chart is that credit spreads are HIGHLY correlated with the VIX.

HY and Investment Grade Credit Spreads

The chart on the next page shows that high yields spreads are also highly correlated with spreads on investment grade. Consequently, as we know that changes in volatility are highly correlated to changes in high yield spreads, we can also deduce that volatility and investment grade spreads are also highly correlated.

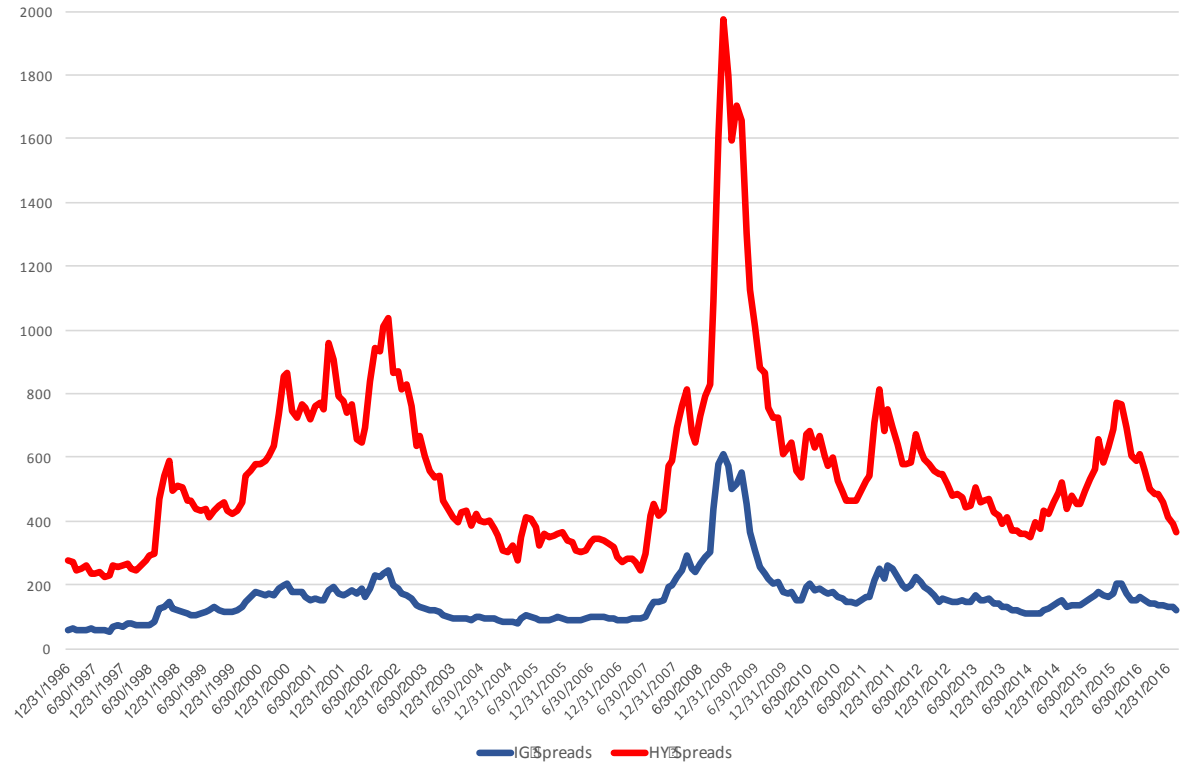
Chart 5 at the top of the following page shows high yield and investment grade spreads from 1996. Notice the high degree of correlation between the two. However, if you look closely, you will notice that the right hand and left hand scales are different. To see the impact of changes in volatility on both HY and IG spreads it is helpful to plot the spreads on the same axis as shown in chart 6.

Chart 5: HY and Investment Grade Credit Spreads



Source: Bloomberg

Chart 6: HY and Investment Grade Credit Spreads

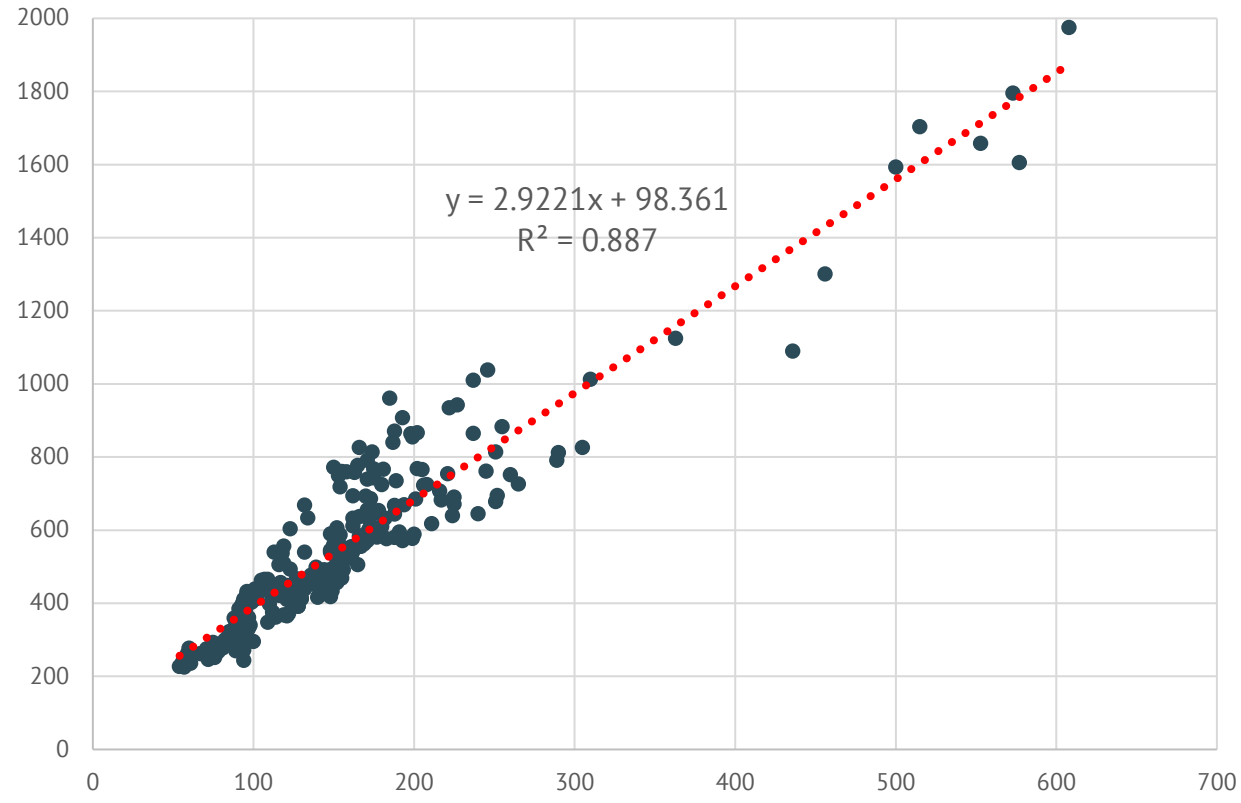


Source: Bloomberg

What should be obvious from chart 6 is that when shocks occur, the impact on HY spreads is much greater than the impact on investment grade spreads. What this demonstrates is that bonds with the same duration DO NOT behave in a similar fashion when subjected to a change in short term interest rates or any other factor that causes credit spreads to widen. So, if you have two bonds, one sub investment grade and one investment grade, both with a 3-year duration, the one with the lower credit rating will usually react more negatively.

To illustrate this, consider chart 7 which plots the spread of the BoA/Merrill Lynch High Yield on the vertical axis against the equivalent investment grade index.

Chart 7: HY and Investment Grade Credit Spreads



Source: Bloomberg

Again you can see how movement in spreads are highly correlated with each other. On average, at the index level, high yield spreads have moved 292 basis points for every 100 basis points move in investment grade spreads. This relationship is not stable, and sometimes high yields move a lot more, and sometimes a lot less. What we can say though is that, very roughly, high yield bonds have moved three times as much as investment grade. So a high yield bond with a 3-year duration will have roughly the same risk as an investment grade bond with a 9-year duration.

An alternative way of looking at this is to think about why we have credit spreads in the first place. The spread is the additional compensation for bearing the risk of owning corporate credits rather than government bonds. If the perception of investors is that credit risk has increased by 10% then we would expect credit spreads to also widen by 10%. This will mean that, as a rule of thumb, credit spread will tend to widen or narrow in proportion to the spread. So a high yield bond with a spread of 500 over will widen (or narrow) 5 times as much as a bond with a spread of 100 basis points.

Duration

At Stratton Street we use the concept of duration times spread (DTS) as a measure of risk. This takes into account the fact that bonds of different credit quality are more sensitive to external shocks, be that a change in interest rates, increased political risk, or a myriad of other factors that influence credit risk. DTS is a much better measure of bond risk than duration alone which is a poor measure of the riskiness of a particular bond.

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