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Should spreads be tighter in a structurally lower default world?

Jim Reid
Strategist
+44-20-754-72943

Nick Burns, CFA
Strategist
+44-20-754-71970

Welcome to the 21st edition of our annual default study - a report we have been publishing since 1999.

We have now completed a 15-year period during which defaults have been ultra-low relative to the past. We think much of this is due to a collapse in real yields over the period. Given the excessive debt burden the world has (mostly outside of the corporate sector), it seems likely the authorities will try to ensure real yields stay historically low in the years ahead, regardless of what happens to nominal yields. Thus, defaults could continue to stay structurally low in the years ahead, notwithstanding the obvious spike when the next recession hits. Given this, we debate whether 'average' default rates from history that many credit valuation models use is less meaningful in the current world. This is important, as the average HY spread has been identical over the last 15 years as it was in the high default world of the previous 20-plus years. Thus, spreads haven't adjusted for the new normal, leaving higher buy-and-hold excess returns available.

The problem, though, is liquidity. Most investors are mark-to-market, and when the cycle turns, the desire to protect returns will send credit investors fleeing to the exit in a market that has no ability to warehouse the risk. So, we think this next negative spread cycle could easily be the third most severe on record (behind the GFC and the Depression), even if defaults will be manageable. Given that many variables point to our being late cycle, this is a major worry over the next couple of years.

Consequently, on a buy-and-hold basis, credit is attractive in this low-default-policy-driven world, but liquidity risk is going to be a problem first.

The report includes our essay on the current default landscape relative to long-term history and also all the usual charts of where spreads are relative to various default scenarios based on history.

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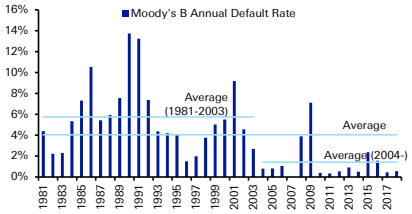
One-page macro summary

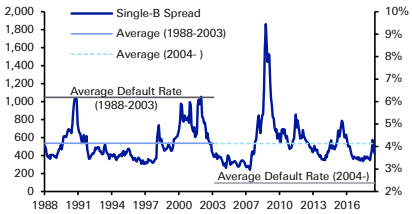
- The concept of "average" default risk has become increasingly challenged as we have now completed 15 years of ultra-low defaults. The prior 20-25 years when the HY market started its development arguably saw the highest period of structural defaults for all rating bands through history.
- Hence, the HY market has emerged since the early 1980s in two distinct periods. The ultra-high pre-2004 period (average B defaults 5.7% p.a.) and the ultra-low post-2004 period (B defaults 1.4% p.a.). Ironically the latter period has seen much weaker economic growth. So average default rates used by valuation models blend two very extreme periods. But which is more realistic?
- A big difference between the two periods is real yields. The 1980s/90s saw some of the highest real yields in history and the post 2004 period some of the lowest. Given how much debt there is globally, it seems likely the authorities will be forced to keep real yields low for a long period of time. So, notwithstanding the higher defaults associated with the next recession, we think we're more likely to continue in a structurally low default world as far as the eye can see.
- Average spreads have been identical in both the pre/post 2004 period, which means investors are now better rewarded for default risk, especially if you think this low-default environment continues. There is even some evidence European defaults have been structurally lower than US defaults over the last 15 years. Given that European HY spreads are wider than in the US, one could argue buy-and-hold European HY investors have a lot of default protection embedded in spreads.
- A look at long-term credit fundamentals shows corporates are levering up in this cycle but that this is more of an IG than HY story and therefore reduces the default implications. Leveraged loans are a concern, but it's not clear the increase in cov-lite issuance will bring large-scale defaults in the next cycle as without covenants there are fewer triggers. Overall, we don't think corporate fundamentals will cause this cycle to turn but will clearly deteriorate when it does.
- However, we don't believe the next recession will be so much about default risk (outside of the natural increase) but instead more about liquidity risk. Since the GFC the size of the credit market has increased dramatically, but regulation has sharply cut dealer liquidity. In a recession we will likely see one-way selling and large gap risk for spreads. We would expect this to be the third-worst cycle for spreads in history (behind the Depression & GFC), given these structural technical deficiencies in the market. A large BBB market vs. HY will also exacerbate the technicals when downgrades occur. As many indicators are late cycle, this is a real risk over the next couple of years.
- Thus, a high-debt, low-growth, low-real-yield, low-default, low-liquidity world. A challenging combination for investors, but one in which buy-and-hold excess returns in credit should be relatively decent relative to long-term averages, but mind the gap spread risk in the next recession.

Figure 1: Are average default rates meaningless? Big step down >'04...



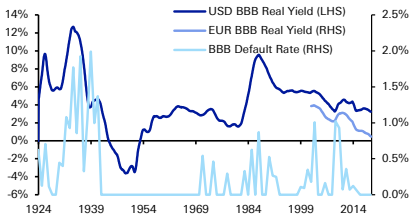
Source:Moody's

Figure 2:.. but no step down in spreads. Average identical pre/post '04. Should spreads be structurally tighter?



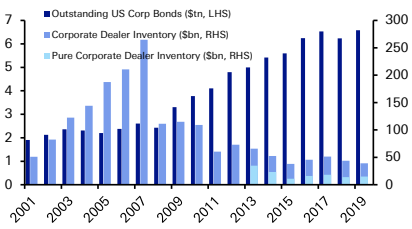
Source:Deutsche Bank, FactSet (ICE BAML), S&P

Figure 3: Real yields a big driver of defaults through time.



Source:Deutsche Bank, Bloomberg Finance LP, GFD, Moody's

Figure 4: Liquidity a far bigger concern than defaults in the next recession..

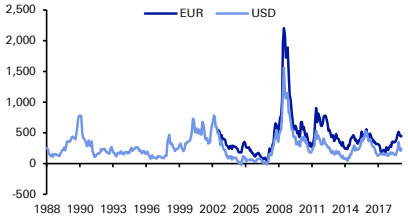


Note: New inventory series since 2013
Source: Deutsche Bank, NY Fed, Bloomberg Finance LP

One-page credit summary

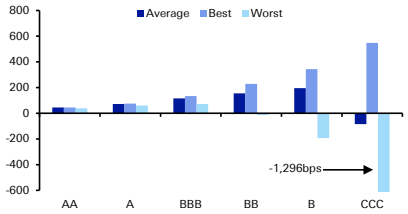
- The 5-year cumulative default rates for the latest cohorts are broadly unchanged from the previous year. They are the same for BBs (3.8%) and marginally higher for Bs (14.0% vs. 13.7%). Hence, from a historical perspective default rates remain very low, and this leaves the spread required to compensate for default for BBs (46-77bps) and Bs (182-304bps) well below current spread levels across all currencies.
- Post lower defaults since 2004 there are no 5-year realised BB/B default cohorts that require a wider spread to compensate for default than current spreads when assuming a 40% recovery. Even dropping the recovery to 0%, only the 08/09 B cohorts would have required a wider spread. Current CCC spreads are tighter than the spread required to compensate for default for every cohort since 1997.
- IG- and BB-rated credit has always provided wider spreads than what is required to compensate for default through an average cycle. Even B DSPs[1] have remained positive since the GFC, getting no tighter than 130bps for USD Bs at the 2018 tights. In 2018 CCC DSPs turned negative, and, whilst they bounced back into positive territory in Q4, the current levels are below 60bps for USD and 100bps for EUR.
- For both USD and EUR credit, Bs currently provide the widest DSP if we assume an average default cycle with a 40% recovery. This shifts to BBs as we lower the recovery assumption and for USD credit to BBBs when assuming a 0% recovery. Outside a benign default scenario, CCC DSPs tend to be negative based on current spread levels. The only exception is for EUR CCCs, assuming an average default cycle and 40% recovery.
- If defaults remain structurally lower, then we would expect HY to outperform IG on a buy-and-hold basis, with Bs likely outperforming BBs. Defaults would have to be very benign for CCCs to outperform.
- Spread-implied default rates for both EUR and USD CCCs are lower than the worst observation, assuming a recovery of 20% or lower. With the exception of EUR BBs, assuming a 40% recovery, all other HY implied default rates sit between the long-term average and worst observation.
- For CDS, current IG index spreads as well as CDX HY spreads imply default rates higher than the current rating-implied levels (based on averages). However, for Crossover the implied default rate over 3 years is actually lower than the rating implied rate when assuming a recovery of 20% or lower and at the 5 year tenor when assuming a 0% recovery.
- CDX HY provides the widest DSP, unless we assume a 0% recovery when both iTraxx Main and CDX IG provide slightly wider DSPs. iTraxx Crossover provides a wider DSP than the IG indices when we assume a 40% recovery, but, when we lower the recovery, then the IG DSPs are wider with the Crossover DSP negative at a 0% recovery.

Figure 5: B DSP (bps)



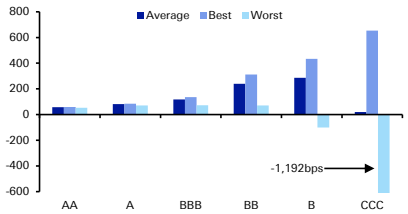
Source:Deutsche Bank, Markit Group

Figure 6: USD Non-Fin Cash DSP (bps)



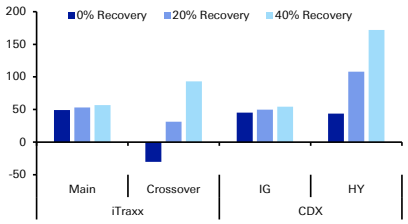
Source:Deutsche Bank (assuming 40% recovery)

Figure 7: EUR Non-Fin Cash DSP (bps)



Source:Deutsche Bank (assuming 40% recovery)

Figure 8: CDS Index DSP (bps)



Source:Deutsche Bank

1 Default-spread premiums (DSP) for cash bonds calculated by subtracting the spread required to compensate for default for a given default and recovery assumption from the index-spread level.

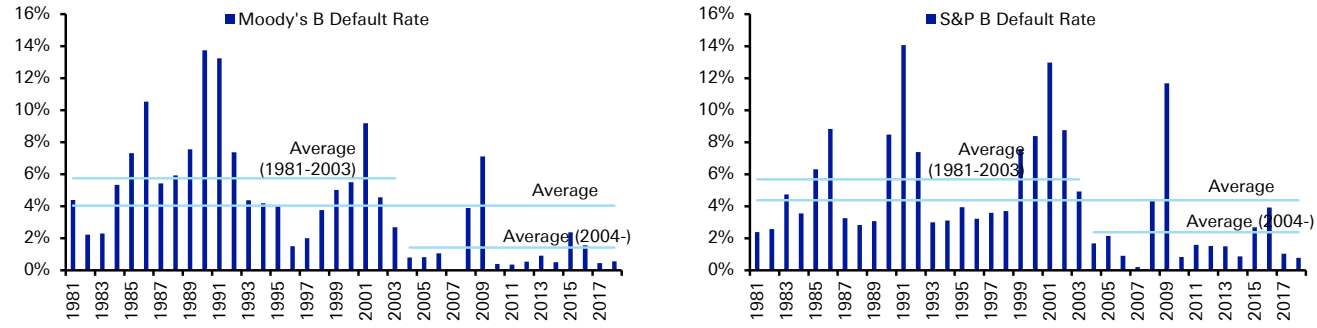
Are spreads too wide for the default environment?

The concept of "average" corporate default risk through time has become increasingly challenged in the modern world as we've now just completed a 15-year period of ultra-low HY defaults. So, what is the correct default rate to use when trying to assess value in credit, and will the current structurally low default world continue for the foreseeable future? The answer to the former question likely depends on the answer to the latter; so, in this piece we try to further understand the last 15 years by looking at the conditions that have prevailed and also at where fundamentals are left.

For most of this chapter where we analyse big-picture trends in the market, we use single-Bs as a proxy for HY default rates, as it allows us to use a consistent cohort through time. If we used HY default rates, the data would be biased by the long-term decline in the average rating of the index, as more and more lower-rated companies have come to the market.

HY markets began to establish themselves in the early 1980s, as companies began to issue with a HY rating rather than the market being predominantly made up of debt from fallen angels. Hence, when we calculate average default rates, we have nearly 40 years of data to look back upon. Figure 9 looks at Moody's and S&P global (heavy US bias) single-B default rates over this period. For the rest of this report we'll mainly use the S&P data.

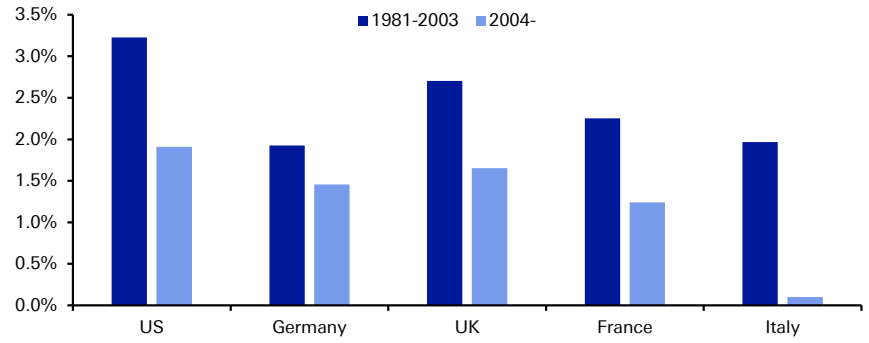
Figure 9: Moody's (left) and S&P (right) Single-B Annual Default Rates



Source: Deutsche Bank, Moody's, S&P

For single-Bs - the largest part of the HY market in terms of number of rated issuers - the first 23 years (1981-2003) saw an average default rate of 5.7%. However, since 2004 this has plummeted to 1.4% (Moodys) and 2.4% (S&P). A stunning step change down, especially when you consider average real GDP in the US, Germany, UK, France, and Italy was 3.2%, 1.9%, 2.7%, 2.3%, and 2.0% in the former period and 'only' 1.9%, 1.5%, 1.7%, 1.2%, and 0.1% in the latter period.

Figure 10: Annualised GDP Growth 1981-2003 vs. Since 2004

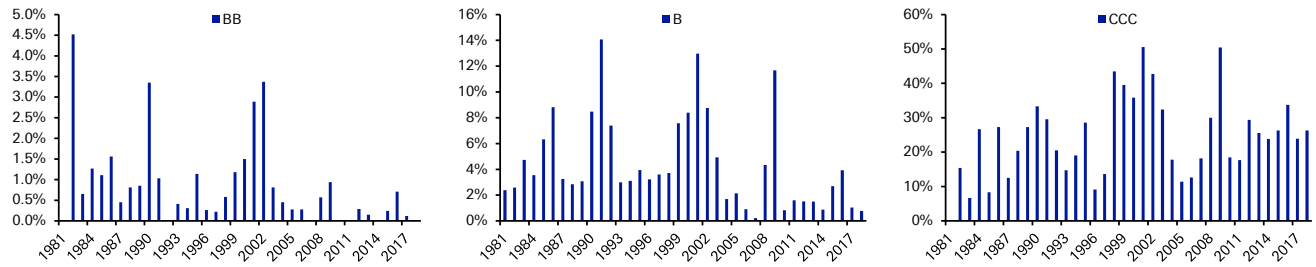


Source:Deutsche Bank, GFD

Therefore, anyone modeling for default risk must surely wonder whether the 'average' single-B default rate over the entire period since 1981 of 4% (Moody's) or 4.4% (S&P) accurately reflects the 'modern' default risk in HY markets.

To show that looking at Single-Bs alone isn't unrepresentative of the HY market, Figure 11 shows BBs and CCCs alongside B-rated annual defaults through history.

Figure 11: Annual Global Default Rates by Rating



Source: Deutsche Bank, S&P

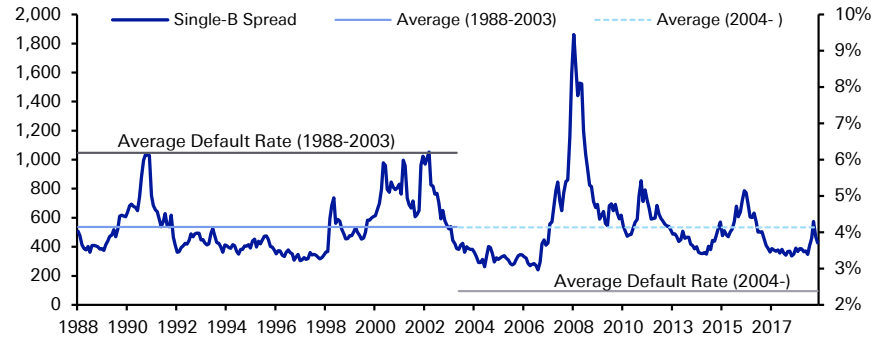
The results for BBs confirm the findings of Bs, although the sharp difference between the pre- and post-2004 period looks slightly less extreme as defaults are floored at zero. It's fairly remarkable that since the GFC 4 of the 9 years have seen 0 BB defaults, and in only one of the years has the BB default rate risen above 0.3%. In the 29 previous years we only saw 3 years with no BB defaults, and the annual rate was more than 0.3% in 22 of those years. Also, for BBs the GFC hardly creates a ripple of default activity.

However, CCCs are the exception, as there has been no obvious step down in defaults post 2004. A word of caution would be there would have been a small sample size in the first half of this period. It is possible, though, these companies are so stretched that low funding costs alone can't protect them from the weaker economic environment. However, it's tough to overgeneralise here.

So, for the vast majority of HY (i.e., BB and Bs), defaults have notably declined post 2004. Interestingly, spreads haven't seen the same step down as Figure 12 shows. For USD single-Bs the average spread in the period from when our spread data

starts in 1988 to the end of 2003 (the high default period) was 537bps. However, since the start of 2004 the average spread is 534bps - pretty much identical.

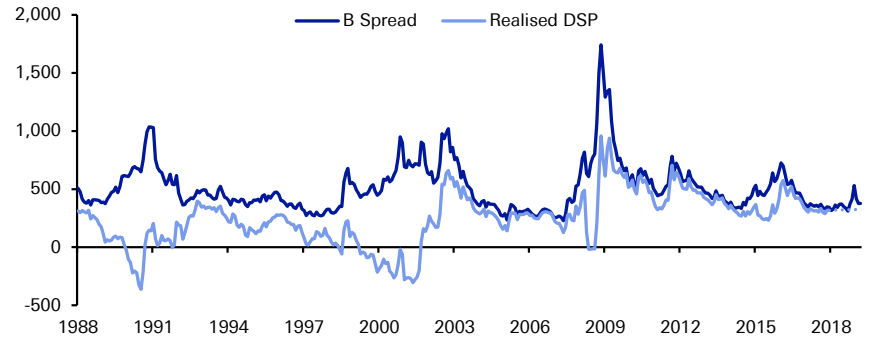
Figure 12: USD Single-B Spreads (bps)



Source: Deutsche Bank, FactSet (ICE BAML), S&P

With average spreads unchanged through history but with defaults structurally lower, then the excess spread earned above and beyond what was needed to compensate for default in HY should have increased through time. Figure 13 tries to approximate this. We have calculated a realised default spread premium over time where we subtract the spread required to compensate for actual defaults over 12 month rolling periods from the starting single-B spread.

Figure 13: USD Single-B Spreads vs. Realised-Default Spread Premium[2] (bps)



Source:Deutsche Bank, FactSet (ICE BAML), Moody's, S&P

The analysis clearly shows a step change up in the excess spread that's been on offer since around 2004 relative to default risk. Spreads have remained unchanged, whereas defaults have reduced. Hence, investors should now be receiving a higher excess return than they did through history. Clearly default risk isn't the only component as to why investors need excess spreads, but at the end of the day, it's the only thing that subtracts actual returns from a buy-and-hold to maturity investor. It begs the question if this environment continues, should spreads be lower than their pre-2004 average? At the moment there is no obvious evidence spreads reflect the new structural default environment. Therefore, either

2 Realised DSP = Starting Spread - Spread required to compensate for default over the subsequent 12 months

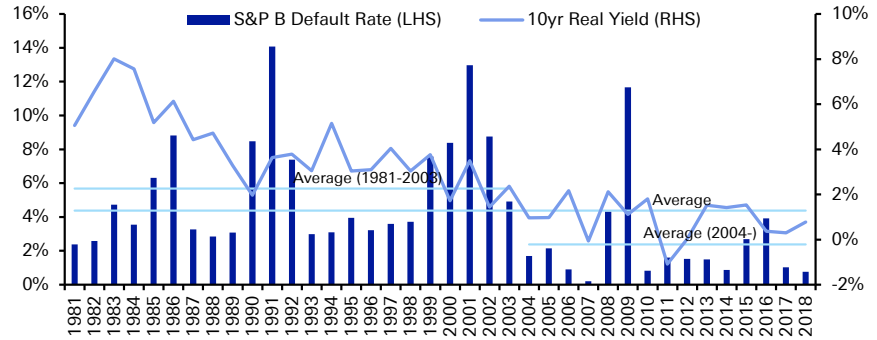
investors now demand a higher premium or they believe defaults will mean revert higher relatively quickly (given the short duration of HY bonds).

So, why have defaults stepped down so much?

The step down in defaults is obviously not a global growth story, looking at the 'before-and-after' numbers shown above. Also the fact 'average' spreads haven't changed too much before and after 2004 suggests lower defaults are not due to more investor participation relative to supply of paper in a period of a rapidly growing market. Had the increased depth of the investor base helped reduce defaults, it should also have created a demand versus supply imbalance, which would have suggested a bias to tighter spreads on a structural basis.

In previous editions of this report we've looked at the influence of lower real yields on defaults, and we are increasingly convinced this is a major part of the story. Figure 14 shows US 10-year real Government yields vs. single-B default rates through time.

Figure 14: S&P Single-B Annual Default Rates vs. US 10-Year Real Treasury Yields



Source: Deutsche Bank, Bloomberg Finance LP, S&P

There does seem to be strong evidence real yields have been structurally lower in the period post the early 2000s recession than they were before. There are numerous explanations, from 1) lower and lower structural inflation finally convincing investors to remove elevated inflation premium from yields left over from the 1970s/80s, 2) the global savings glut, and 3) global QE/NIRP over the past decade. If you believe the authorities have to ensure real yields stay low for years to come given the global debt overhang, it's easy to conclude defaults will remain structurally lower, notwithstanding any inevitable short, sharp spike over any recessionary period. Assuming we see 'normal' length recessions, these default spikes are unlikely to be as severe as those seen between the 1980s and the early 2000s, if our analysis is correct.

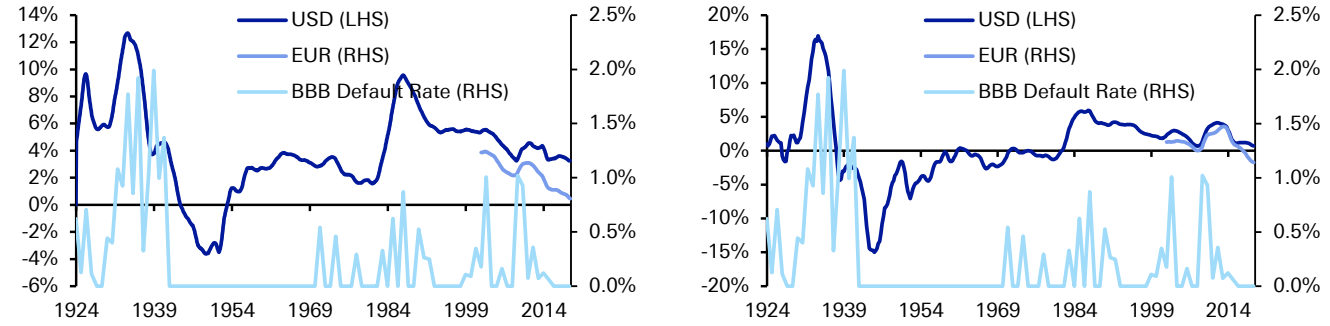
Although HY default rates only started to be recorded with any critical mass from the early 1980s, we can use BBB default rates to see whether there is evidence to suggest a longer-standing relationship between defaults and real yields.

Figure 15 looks at BBB defaults back to the 1920s against 1) a 5-year moving average of US BBB real yields and 2) US BBB yields minus US nominal GDP growth (again a 5-yr moving average). The second measure gives an idea of

funding costs of corporates against the potential profits it can make (GDP as a proxy). Thus, the higher the line is above zero, the more penal financing costs are relative to inflation/economic activity and vice versa. We have also included the data for Europe since we have data from 1999.

The thing that stands out is that outside of the Depression, the highest yields relative to activity/inflation occurred during the 1980s and 1990s – a period that coincided with high structural levels of HY defaults. Today the level is gravitating back towards zero in the US and is accelerating in Europe (and below) faster. Interestingly in the US, BBB yields were well below nominal GDP between WWII and the late 1970s, as high growth, inflation, and financial repression kept funding costs low relative to nominal activity. This was a great time to be a company in terms of seeing your debt erode and having negligible default risk. As can be seen, it corresponds with a long period of zero corporate defaults. There were other things at play - e.g., low levels of corporate debt and a debt market flushed out of weak companies after the 1930s and WWII - but the environment was the opposite to the 1980s and 1990s in terms of funding rates relative to activity and with it defaults.

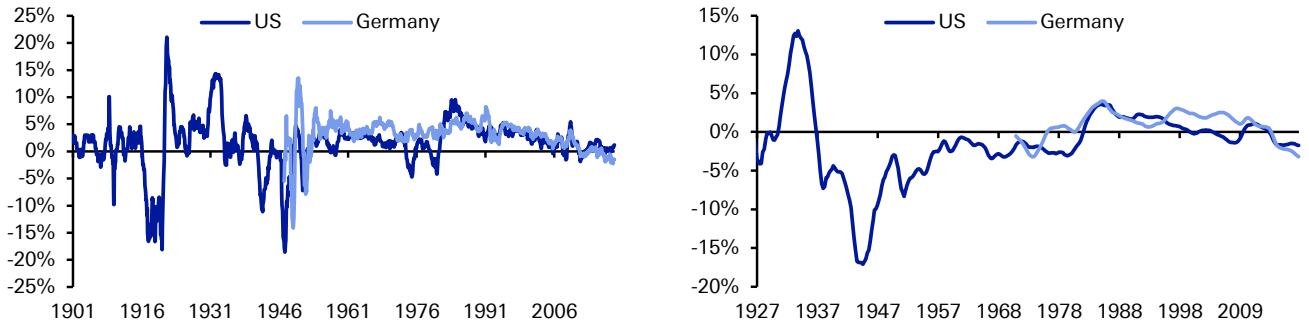
Figure 15: BBB Annual Default Rate vs. 5-Year Moving Average BBB Real Yields (left) and BBB Yields - Nominal GDP (right)



Source: Deutsche Bank, Bloomberg Finance LP, GFD, Moody's

Figure 16 shows these trends in the Government bond market that allows us to look at Europe (via Germany) over a longer period and helps us see the base level of real yields and yields versus nominal GDP for both regions since the start of the 1950s. Again, we can see the step change lower in real yields in the last 15 years relative to the previous twenty-plus years when the HY market was starting to rapidly grow. The graph also shows us that while US real yields are low, German real yields (a good proxy for all of core Europe) are around their lowest since the early 1950s. It's a similar picture for yields relative to nominal growth. So, although we don't have European corporate bond data prior to the start of the Euro in 1999, the current funding conditions for corporates in real terms are at levels that likely haven't been seen in several generations. These really are extraordinary times for core country European corporate funding levels.

Figure 16: US and German 10-Year Real Yields (left) and 10-Year Yields-Nom GDP (5yr MA, right)

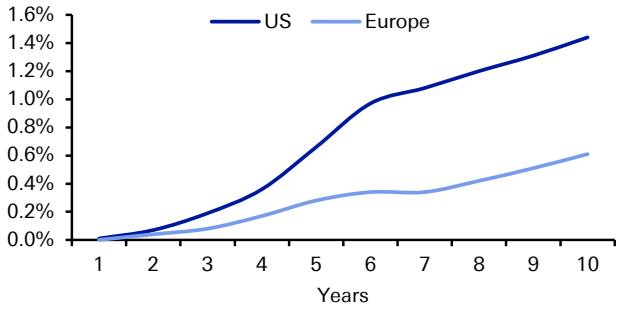


Source: Deutsche Bank, Bloomberg Finance LP, GFD

Are European defaults becoming structurally lower than US?

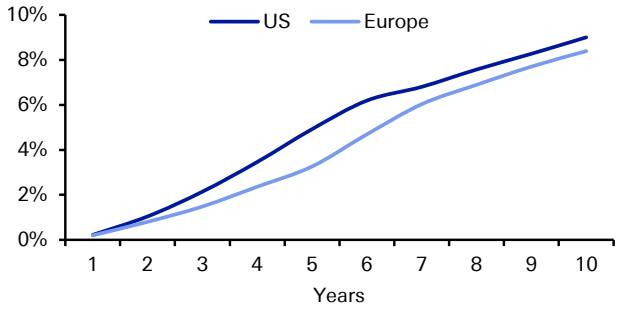
So far, we have used global defaults which have a US bias that is slowly reducing over time due to the growth of the European corporate bond market. By the early 2000s, the European market began to gain some critical mass, and we can therefore start to compare the two. Figure 17 - Figure 20 show the average cumulative default rates of US and European non-financial companies by rating band (BBB-CCC) from 2004-2018.

Figure 17: BBB Average Cumulative Default Rate US vs. Europe



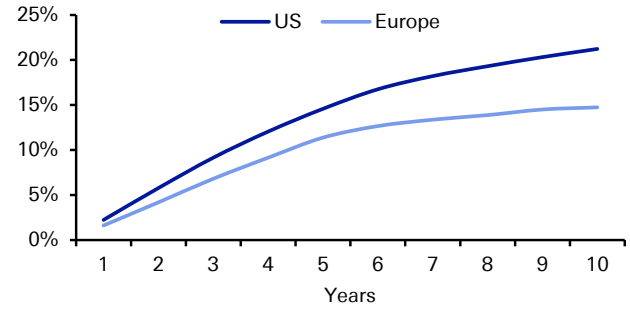
Source: S&P

Figure 18: BB Average Cumulative Default Rate US vs. Europe



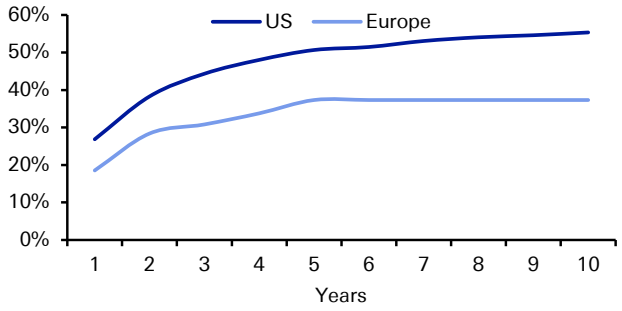
Source: S&P

Figure 19: B Average Cumulative Default Rate US vs. Europe



Source: S&P

Figure 20: CCC Average Cumulative Default Rate US vs. Europe



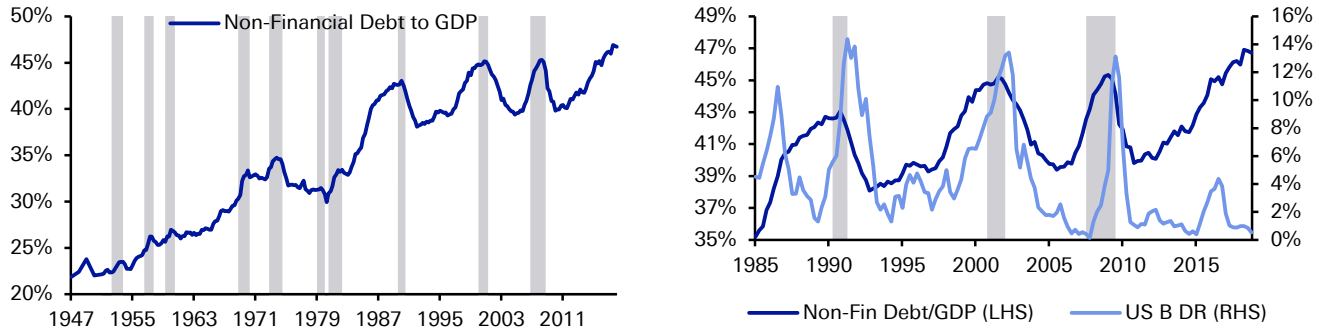
Source: S&P

Interestingly, despite the problems Europe has had over this period, defaults have been lower across all rating bands. It is possible this is because of differences in the bankruptcy process and perhaps due to more state intervention in Europe. Europe is also perhaps more likely to see Japan-like zombification of companies where ultra-low rates keep them alive but with the profit outlook much weaker than for most US companies. Given that all buy-and-hold investors actually want is their coupons paid and their principal returned, there is an argument for suggesting Europe should have tighter spreads than US credit to reflect the lower default risk. The counterargument would be the higher existential risk in Europe, especially with regards to Italy. It is hard to be certain the Europe of today will be the Europe in the next 3-5 years. However, it is interesting to see European default rates have, on average, been structurally lower over the past 15 years in spite of all its existential problems to date.

Ultra-low yields versus higher corporate debt

We have talked a lot about low real yields driving lower levels of defaults, but such an environment isn't new through history, even if we are back closer to historical lows. We have seen real yields low or negative before and these times have generally coincided with low default environments. As a word of caution, though, it's fair to say debt levels are now much higher than they were the last time real yields and default rates were structurally as low as they are today. Indeed, US corporate debt/GDP has never been higher. Should this be more of a concern for default risk? Figure 21 shows US non-financial debt to GDP versus recessions through history and relative to single-B default cycles. Obviously, most corporate debt will have come from IG issuers through time, but this analysis provides a long-term prospective of US debt trends relative to GDP.

Figure 21:US Non-Financial Debt to GDP vs. Recessions since 1947 (left) and vs. the Single-B Default (right)



Source:Deutsche Bank, Bloomberg Finance LP, Moody's

Certainly, overall debt levels look worryingly high, which at face value should concern those looking at the risk of a return to more elevated default rates. However, when you dig beneath the numbers in more detail, we can become more sanguine when looking at US corporate fundamentals and with it the risk of a sharp rise in defaults, even when comparing to long-term history when overall debt was a lot lower.

In the next sub-section we will look at US corporate debt over time using the economy-wide data, that from the S&P, and that more directed at the constituents of corporate-bond indices.

US Corporate Debt - How worried should we be?

We start by looking at the economy-wide data. The first thing to note is that as the world has become increasingly more levered over the last several decades, US corporates have been relatively measured in how much leverage they have been prepared to add. Relative to debt in the rest of the US economy, US corporates actually de-levered between 1975 and 2011. Since then, US leverage has increased relative to the rest of the US economy, but we are still at levels at the low end of the historical range.

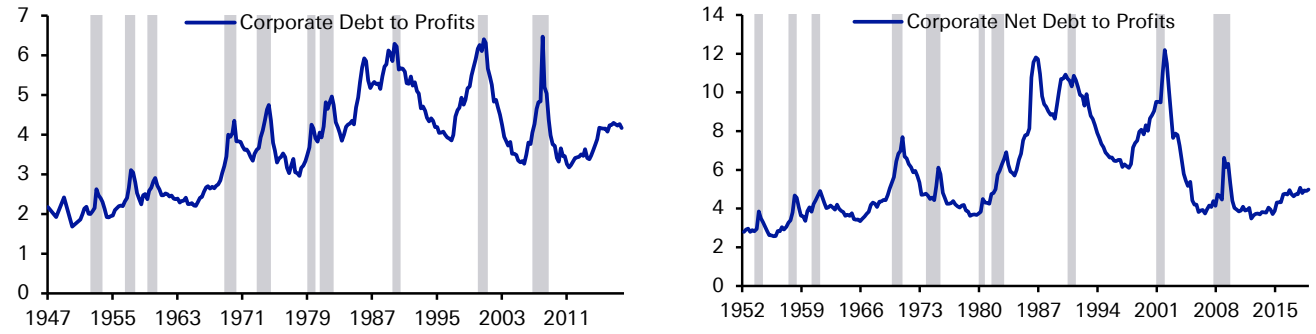
Figure 22: US Corporate Debt as a Percentage of Total Debt

Source: Deutsche Bank, Federal Reserve

This is only a small part of the story, though. In Figure 23 we show US corporate debt to profits. Companies do not pay debt out of GDP; they pay them out of

profits. Because corporate profits are such a high share of GDP at the moment - and have been for the last few cycles - debt levels look relatively mild on this measure, and the increase in this cycle also looks fairly tame. In terms of net debt, the picture looks even more sanguine with leverage on this measure running at the lower end of its 70-year range. Interestingly, the high default era of the 1980s was where this ratio was structurally the highest through history.

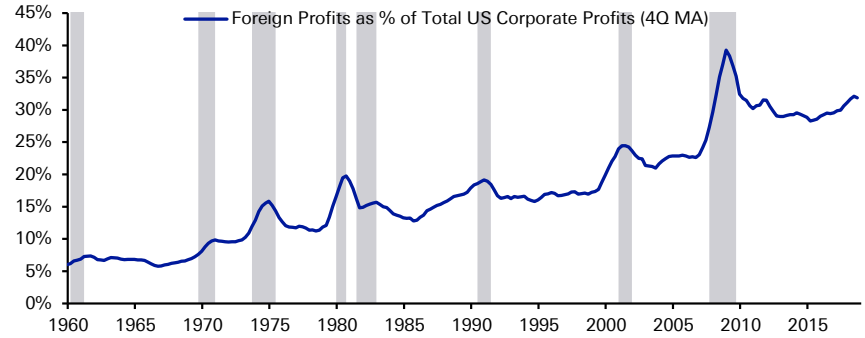
Figure 23: US Gross (left) and Net (right) Debt to Profits



Source: Deutsche Bank, Federal Reserve

What helps the measure based on profits more than the one based on GDP is the fact that profits from abroad have increased over time. Figure 24 shows how this has evolved over the last several decades.

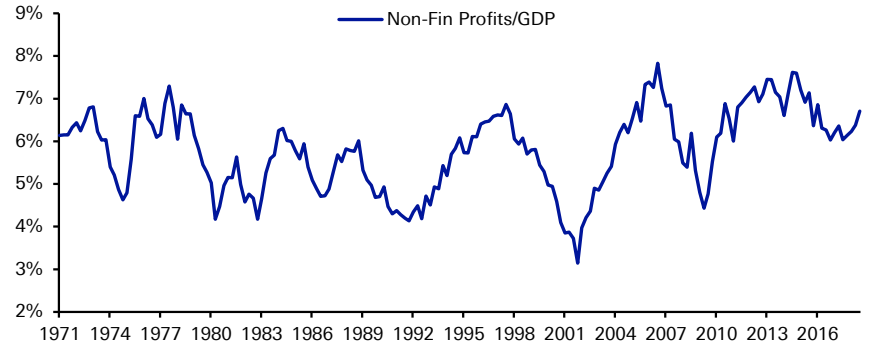
Figure 24: Foreign Profits as a Percent of Total US Corporate Profits



Source: Deutsche Bank, BEA

While on the subject of profits, they should generally track nominal GDP; however, it's fair to say we continue to live in a world of structurally high profits, even if we are off the peaks of this ratio seen in the middle of this current decade, as Figure 25 shows. This undoubtedly helps maintain the current lower default world relative to the longer-term averages.

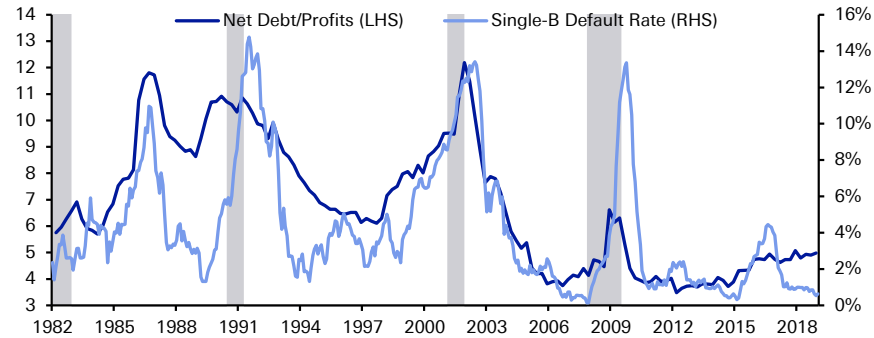
Figure 25: US Non-Financial Corporate Profits to GDP



Source: Deutsche Bank, BEA

Figure 26 shows the relationship between leverage (net debt to profits) and single-B default rates through time. Again, we're using single-B defaults as a proxy for the overall default environment and are fully aware the national accounts data is a broader series skewed more towards the larger companies with higher earnings. These companies also tend to have IG-credit ratings.

Figure 26: US Corporate Leverage (Net Debt/Profits) vs. Single-B Default Rates



Note: Grey shaded areas indicate recessions.
Source: Deutsche Bank, Federal Reserve, S&P

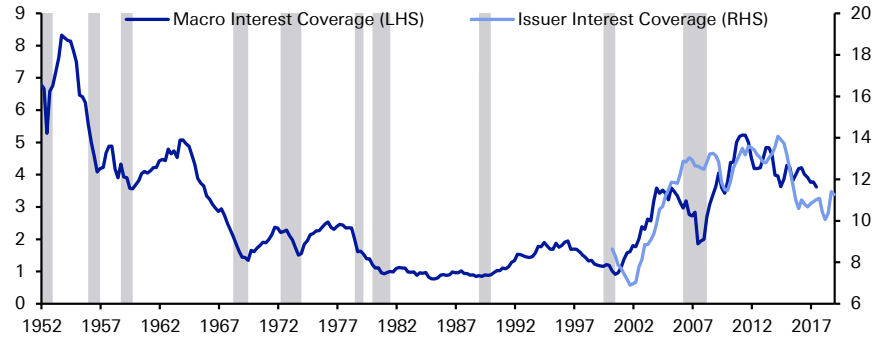
Net debt/profits was structurally much higher in the more elevated default era of the 1980s/90s than it has been over the last 15 years. Even during the 2008/09 financial crisis net debt/profits only increased to levels consistent with the best point of the 1990s expansion. This might help further explain why the GFC default cycle for corporates was so mild - a sharp but brief spike only.

We can also approximate for long-term interest cover by looking at US non-financial debt levels over time and assuming funding costs comparable with Moody's long-term average US corporate bond yield. This is an IG series but is again a good proxy for all credit. Given the two series are not directly comparable, the measure of units are meaningless, but the changing ratio over time is the key here. To check for data integrity, we have overlaid our own US corporate-bond interest cover data, taken from actual issuers in the index back to 2000 where our data starts. In the overlap period, the general shape of the two lines is pretty

similar, which suggests our proxy might be a good guide to interest cover over time.

What's interesting is that although interest cover has fallen over the last 3-4 years as yields have risen, current levels are still above anything seen from the mid-1960s to early-mid-2000s. In particular, the high-default era we've discussed at length – that is, the 20-year period post the early 1980s – saw the lowest interest cover of any period in our 70-year calculation of this variable. This is another piece of evidence suggesting 'average' default rates since 1981 might be artificially skewed by the exceptionally high defaults during the first half of this period.

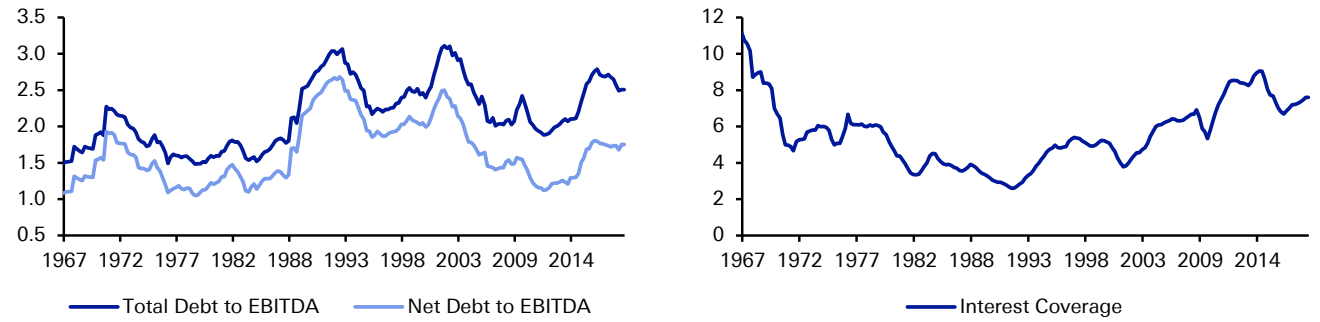
Figure 27: Long-term US Corporate Interest Coverage Proxy



Source: Deutsche Bank, Federal reserve, Moody's

The analysis conducted so far can be corroborated using debt and interest coverage ratios for S&P 500 companies back over 50 years. Figure 28 shows these.

Figure 28:S&P 500 Leverage Ratios (left) and Interest Coverage (right)



Source:Deutsche Bank, Compustat

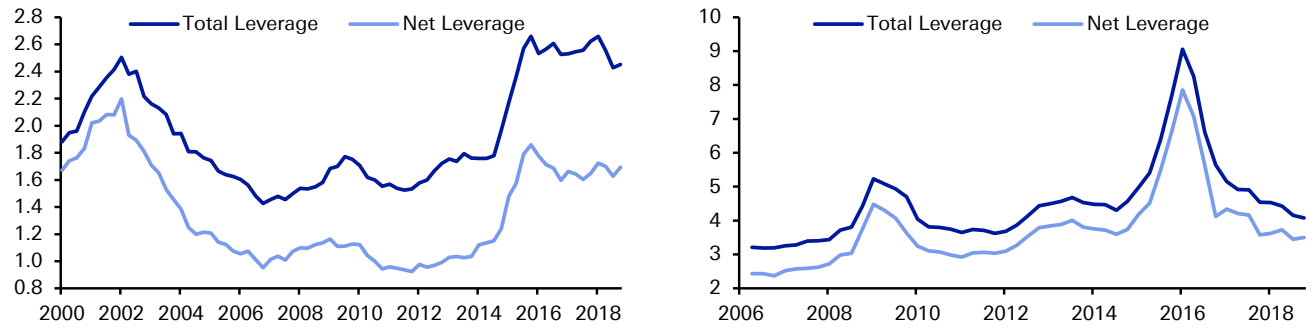
For S&P 500 companies, debt has gone up in this cycle, but total debt/EBITDA is only in the middle of its 30-year range and, as we've discussed before, other sectors of the economy have seen debt increase by more over this period. On a net debt/EBITDA basis we are below the 30-year average and only just above the 50-year average reflecting elevated levels of cash on balance sheets relative to the past. There is obviously a good chance that a large part of this cash sits on the balance sheets of a relatively small number of companies, but it's still an impressive statistic given how high debt levels are relative to 50 years ago.

Although interest cover for the S&P 500 companies is below its highs for this cycle (as interest rates have risen), we are still at coverage levels that, outside of this cycle, are at the highest levels for 50 years. Another impressive statistic that supports our earlier work.

Is this analysis so far representative of the corporate bond market?

For the US corporate bond market we have leverage data back to 2000; hence, we can show total and net leverage for IG and HY companies over this period.

Figure 29: US IG (left) and HY (right) Total and Net Corporate Bond Market Leverage



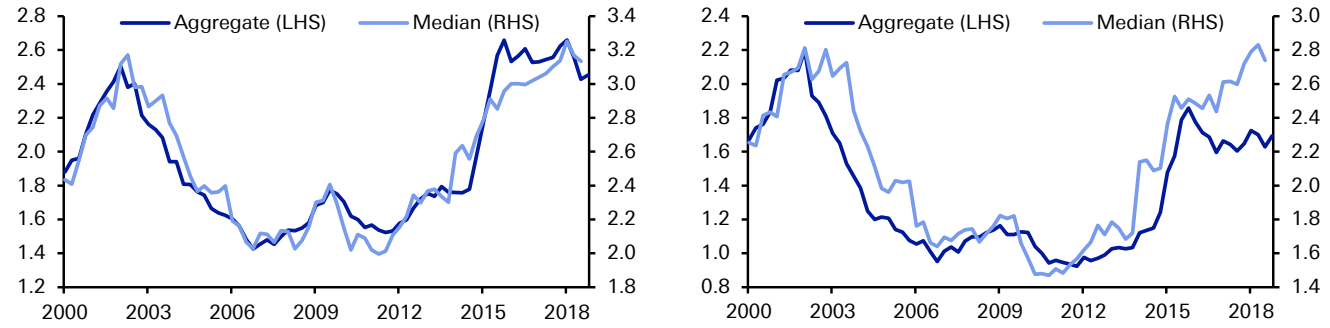
Source: Source: Deutsche Bank, Bloomberg Finance LP

For IG companies, this data is more similar to the Debt/GDP charts rather than the Debt/profits data and shows total leverage hovering around the 2002 level having increased relatively sharply since 2014. Net leverage has seen a similar rise but is still below 2002 levels. We only have aggregated US HY corporate bond fundamentals back to 2006, but they show that outside of the energy crisis total and net leverage has been fairly flat over the last decade with hints that we're 'only' slightly above immediate pre-GFC levels, which was a crisis that wasn't bad in terms of defaults, all things considered.

Thus, there is evidence leverage is higher for corporate bond issuers in absolute terms and relative to history than it is for the economy-wide data but that this higher leverage bias is concentrated in the IG space. Defaults generally come from HY companies; so, the risks here might be future IG fundamentals deteriorating and market technicals being challenged (e.g., IG to HY downgrades). More on this later.

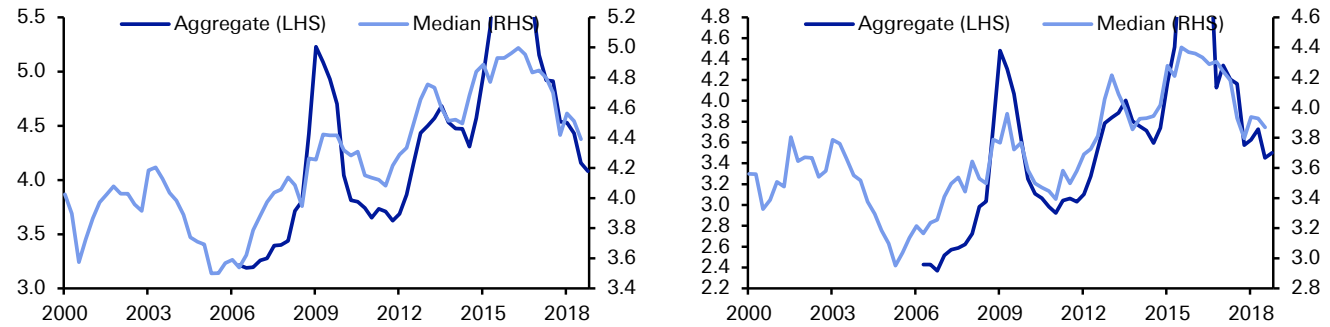
Our numbers are based on aggregates and are therefore weighted to the larger issuers. In Figure 30 and Figure 31 we repeat the exercise to include medians to see whether the larger companies distort the data.

Figure 30: IG Corporate Bond Market Aggregate vs. Median Total (left) and Net (right) Leverage



Source: Deutsche Bank, Bloomberg Finance LP

Figure 31: HY Corporate Bond Market Aggregate vs. Median Total (left) and Net (right) Leverage

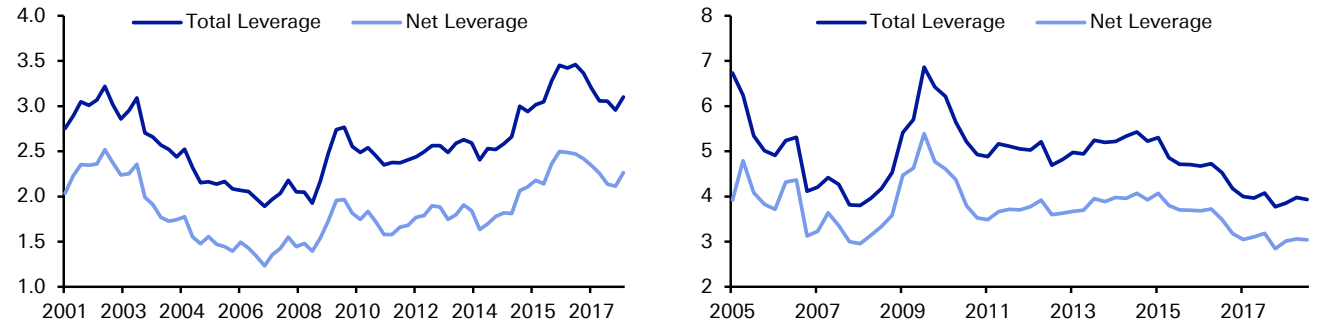


Source: Deutsche Bank, Bloomberg Finance LP

There is no difference between aggregates and medians on a total leverage basis for IG companies, but for net leverage we are back at 2002 levels when looking at the median number. This perhaps reflects the fact that aggregate net leverage numbers are being flattered by the larger companies having substantial cash on their balance sheets. There is little difference for HY companies between aggregates and medians.

For completeness Figure 32 shows European IG and HY corporate bond total and net leverage numbers. For IG they show a similar trend of leverage rising in this cycle and back to 2002 levels but HY leverage has declined to pre-GFC all time lows (albeit with a shorter history) and hasn't seen any evidence of rising in this cycle.

Figure 32: European IG (left) and HY (right) Total and Net Corporate Bond Market Leverage



Source: Deutsche Bank, FactSet

So it's fair to say that when using the corporate bond data, there is evidence to show IG issuers are more levered than the economy-wide or S&P 500 data would suggest. However, at worst they are back to 2002 levels and as discussed before the global economy is now far more levered than it was back then; thus, corporate leverage returning to these levels is not indicative of corporates being more extended than other areas of the economy. Hence, it's hard for us to conclude corporate fundamentals are going to be the catalyst or at the epicenter of the next crisis. Given our earlier work on very low real yields and its correlations with defaults through history, it's also hard for us to believe the next default cycle will be on a par with the default cycles of the early 1980s-early 2000s unless we see a substantially deep and prolonged downturn.

What would structurally raise defaults?

To see a return to the pre-2004 levels of defaults, we think you'd need to see real yields structurally rise and for the era of high corporate profits to mean revert. For real yields it feels that there is so much debt out there in the global economy that policy makers have to ensure that real yields remain artificially low for as far as the eye can see even if nominal yields go up in future years. As for corporate profits, much might depend of whether labour costs start structurally rising again after a near 40-year compression. We think populism and less favourable demographics should mean they do. However, this will be over multiple years and will only slowly impact default risk.

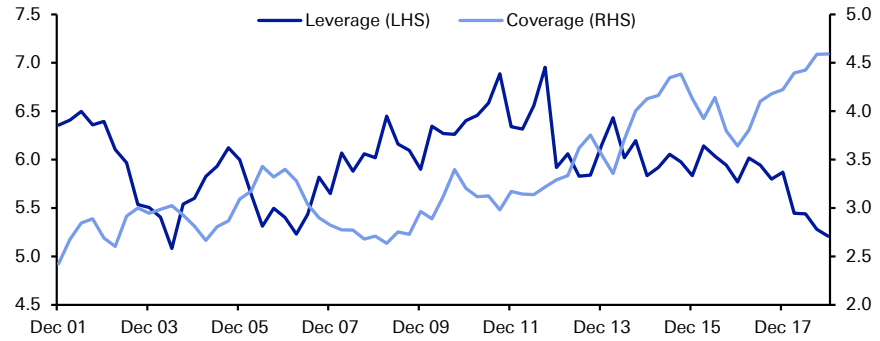
Should we be concerned about leveraged loans?

This is a topic that has received increasing attention in recent months. Whilst we would that it's difficult to draw very strong conclusions we do believe there are some factors in the loan market that are worth keeping an eye on.

Growing leverage

In Figure 33 we start by looking at leverage and coverage for the US leveraged-loan market since 2001. We can see that as with much of our analysis so far, leverage has generally been falling and is broadly in line with the lows seen over the analysis horizon period. At the same time, coverage has risen to its highest level based on this analysis.

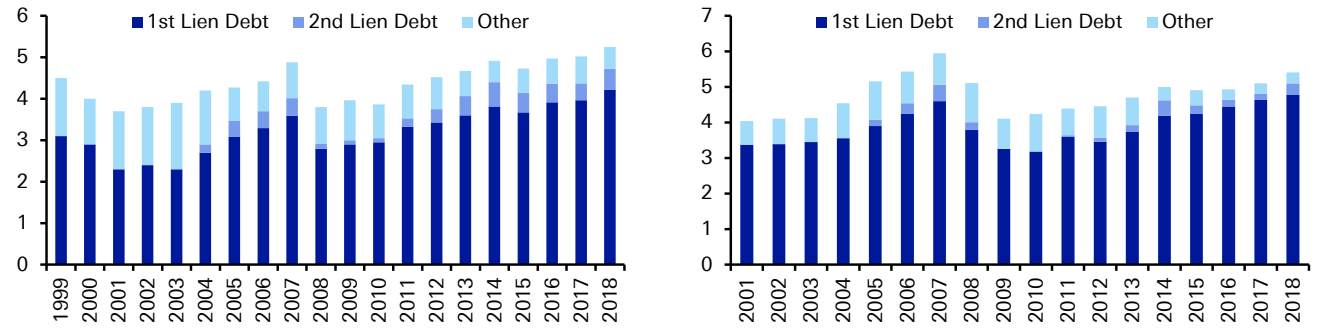
Figure 33: US Leveraged-Loan Leverage and Coverage Ratios



Source: Deutsche Bank, S&P LCD

However, this is arguably not the full story. This data is based only on those issuers that file publicly. So if, rather than looking at the outstanding market, we look at leverage within new deals (including both public and private issuers), then the dynamics of the market take on a slightly different tilt. In Figure 34 we look at average annual leverage for new deals in both the US and Europe. Here we see the trend has been for deals to be priced with increasing levels of leverage. Starting with the US in the lefthand chart, we can see overall leverage has been steadily rising since falling from the pre-GFC peak in 2007 and has now been above that level for the past few years. Last year's level has provided a new peak over the analysed time horizon. Looking at the same for Europe in the righthand chart, we can see leverage has also been slowly climbing, and although total leverage remains below the 2007 peak, leverage through the first lien is now higher.

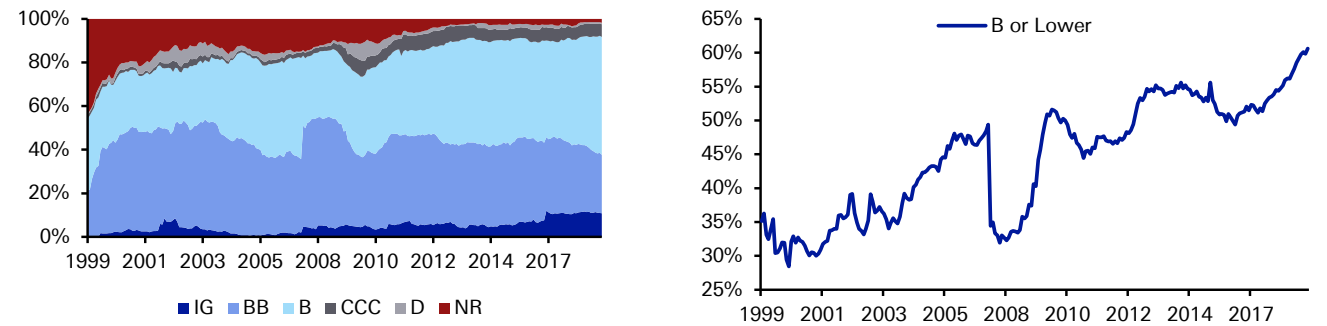
Figure 34: US (left) and European (right) Average Annual New Deal Debt/EBITDA by Seniority



Source: Deutsche Bank, S&P LCD

Arguably a significant factor in these growing leverage number is due to a general deterioration in the overall credit quality of the leveraged loan market. Figure 35 looks at the rating composition of the US leveraged loan index through time. The lefthand chart shows the broad distribution by broad rating band while the righthand chart shows the proportion of the market rated single-B or lower. The key takeaway here is the continued rise in the proportion of lower-rated loans in the index, whether due to new issuance or downgrades. The percentage is now at the highs for the series, just above 60%.

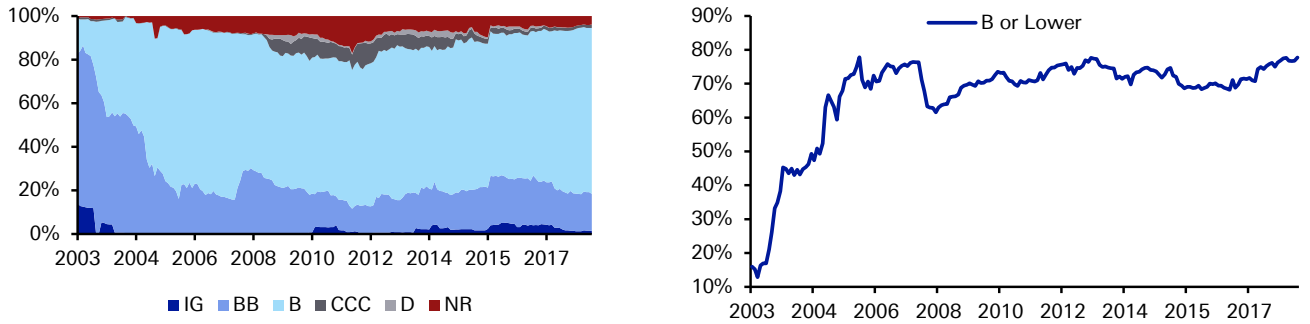
Figure 35: US Leveraged-Loan Index Rating Composition (left) and Proportion of Index Rated Single-B or Below (right)



Source: Deutsche Bank, S&P LCD

In Figure 36 we show the same stats for the European loan market. Whilst the growth in concentration of lower-rated issuers has not happened in the same steady manner as we've seen with the US market, it has nonetheless grown. Around the GFC the proportion of lower-rated loans dropped to around 60%, but it is now back around its peak of just below 80%.

Figure 36: European Leveraged-Loan Index Rating Composition (left) and Proportion of Index Rated Single-B or Below (right)



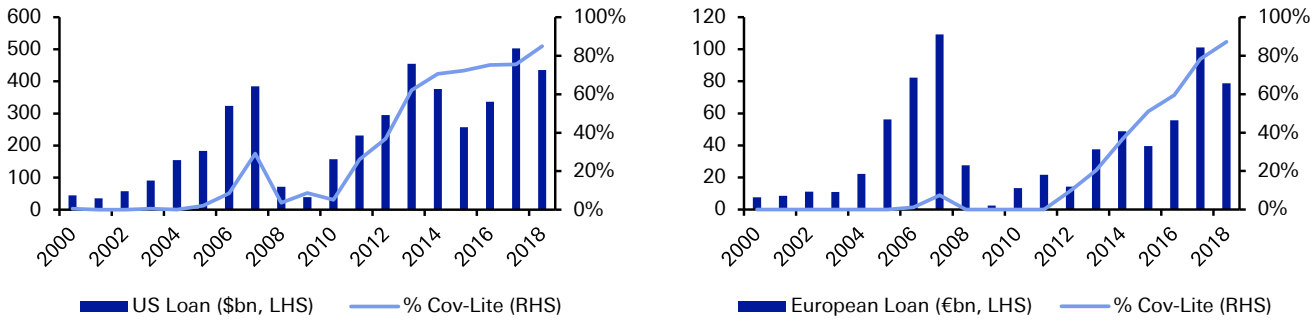
Source: Deutsche Bank, S&P LCD

So, the general deterioration in the average credit quality of the leveraged loan indices has probably contributed to the rising leverage in new deals. The concentration of lower credit quality in the loan market is certainly something to keep an eye on. However, we don't believe this fact alone is likely to lead to the default cycle, but the loan market is certainly exposed to any notable economic slowdown or recession that ultimately leads to a rise in defaults.

The rise of cov-lite loans

Another factor in the loan market that has attracted attention is the weakness in documentation. Cov-lite loan issuance has become the dominant loan format in recent years. Figure 37 highlights the general rebound in loan issuance post the GFC but also the concentration of cov-lite deals. We can see that in the US, having dropped off significantly post the GFC, issuance levels have been above the 2007 peak for each of the past two years. However, the big difference is that in 2007 cov-lite issuance accounted for less than 30% of the total, while in 2018 this was around 85%. In Europe we may not have seen annual issuance in excess of the 2007 total. But the volume in 2017 was only around 7.5% shy of this level, and although supply was notably down last year, it was still higher than any other post-GFC year. The most notable difference with volumes now is that cov-lite deals make up more than 85% of the total, but back in 2007 this was still below 10%.

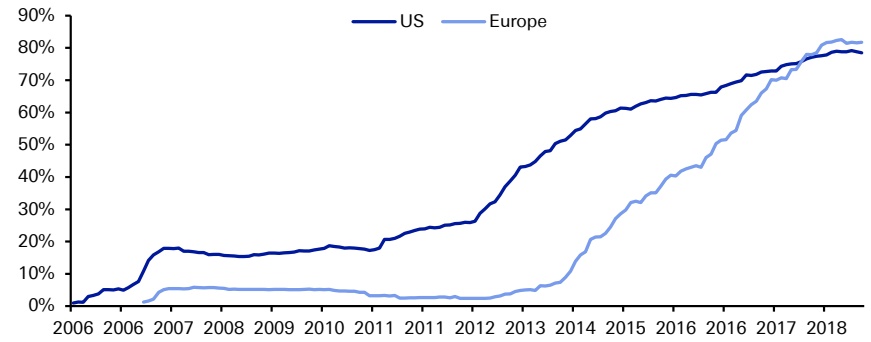
Figure 37: Annual Issuance of US (left) and European (right) Leveraged Loans and Percentage of Cov-Lite Deals



Source: Deutsche Bank, S&P LCD

A slightly different way to highlight the same dynamic is to look at the proportion of the outstanding market that is cov-lite. Prior to the GFC and therefore the last meaningful default cycle cov-lite loans were only around 20% of the US loan market. They barely registered as a component in the European leveraged loan market. We can see that this has risen significantly with cov-lite loans now accounting for just under 80% of the US market and just over 80% of the European market.

Figure 38: Cov-Lite Percentage of US and European Leveraged-Loan Markets

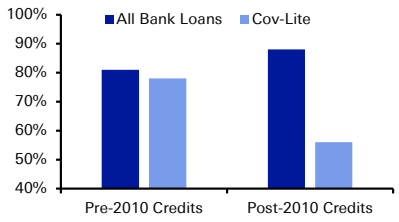


Source: Deutsche Bank, S&P LCD

There's no doubting the rise of cov-lite deals, but what, if any, are the likely consequences of this changing market dynamic the next time the cycle turns and defaults become elevated? First of all, we do not believe the existence or lack of covenants infer creditworthiness, and therefore they will not drive the success or failure of any particular credit. However, it is possible they can contribute to some aspects of how the default cycle plays out.

A widely discussed consequence is that recoveries will likely be lower for cov-lite deals. In Figure 39 we show average discounted recoveries of cov-lite deals compared to the average recoveries for all bank loans. We can see that post 2010, the period when cov-lite loans became more prominent, recoveries for cov-lite deals have been lower than for overall bank loans.

Figure 39: Average Recoveries - Cov-Lite vs. All Loans



Source: Deutsche Bank, S&P LCD

Nonetheless, the cov-lite recovery data is based off a relatively small data set. It could be argued that a bigger issue of the rise of cov-lite loans is the risk of "zombie" companies that manage to avoid default. In a world of very low real borrowing costs, the ability of companies to stay afloat is greater than it might otherwise have been while the lack of covenants means creditors are unable to force the situation as they might have done in the past. This fits well with the themes already discussed in the report that default rates have tended to be structurally lower over the past 15 years. The current dominance of cov-lite loans in the market could add to this dynamic such that it would not be too much of a surprise to see defaults peak at a lower level than we have previously seen. It could also mean defaults get spread out over a longer period.

Overall, there are certainly factors that are worth noting within the loan market, and there seems little doubt that when the economic environment becomes more challenging, the loan market will be exposed. However, we are not convinced that the loan market is likely to be the actual catalyst for the cycle turn. In our view, that is still likely to be a much bigger picture macro event. Given the generally

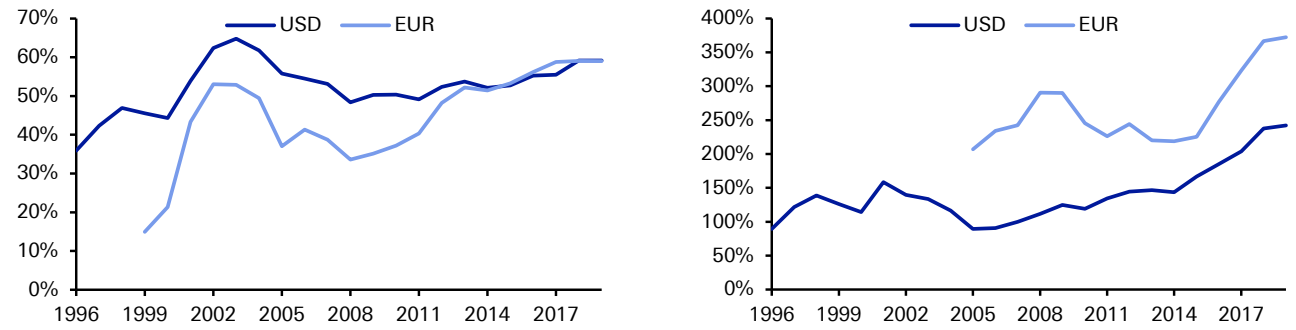
lower-rated nature of the loan market, it is possible the loan market would be more exposed to such an event than other parts of the credit market. Nonetheless, the lack of covenants and still generally low borrowing costs could mean the actual default events are more delayed than we saw in the last cycle. This could also give rise to a situation where the peak in the default rate is much lower than past experience. One outcome we certainly expect is that recoveries are, in general, likely to be lower than we saw through the last default cycle.

Liquidity more worrying than defaults

As discussed so far, fundamentals have deteriorated in this cycle, but much of this has been in IG names. The traditional late cycle levering up of HY balance sheets has been conspicuous by its absence. Given that IG names have very low default risk over 1-2 year periods (see Figure 55 later), this increased leverage is unlikely to lead to a big pick-up in defaults when the next recession hits, especially given the likelihood of real yields staying ultra-low over the next cycle. In a normal recession, HY defaults will clearly pick up, but it feels unlikely that in the next downturn defaults will rival those seen in recessions in the pre-2004 period where real yields were higher.

What is highly likely, though, is that there will be some huge technical problems for the market to deal with in the next recession. As we show in Figure 40 and have pointed out in many previous notes, the size of BBB outstanding bonds has surged in recent years in absolute terms and relative to the HY market[3]. When the economy and fundamentals deteriorate, this will cause more IG names to migrate into (or close to) the HY market than we've seen in previous downturns. This will likely lead to big spread dislocations as the HY market struggles to deal with the size of some of these "super" BBB issuers. However, this will be a gap risk for spreads more than for default risk.

Figure 40:USD and EUR Non-Financial BBBs as a Percentage of IG (left) and HY (right)

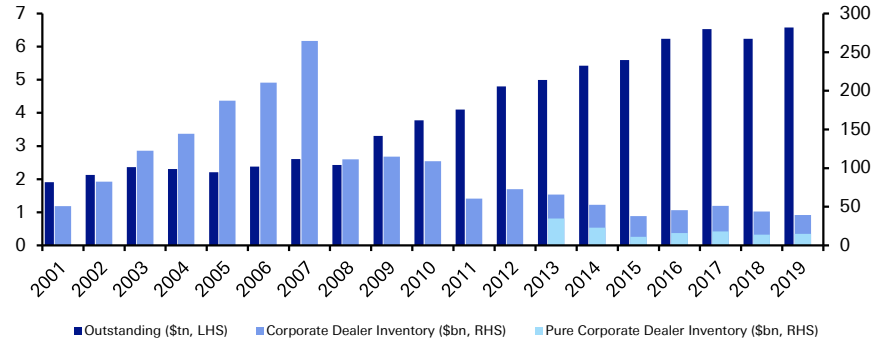


Source:Deutsche Bank, ICE BAML

More importantly, the overall market dynamics have shifted aggressively since the GFC. Figure 41 republishes a chart we have shown on numerous occasions over the last several years detailing that the US corporate bond market has near tripled in size since the GFC due to QE, lower yields encouraging companies to issue and high demand for fixed income and spread product, thus providing a captive pool of capital. Meanwhile, regulation has ensured dealers/market-makers have less and less ability to warehouse risk. Figure 42 then looks at US IG, HY and Treasury daily trading levels relative to the size of the market.

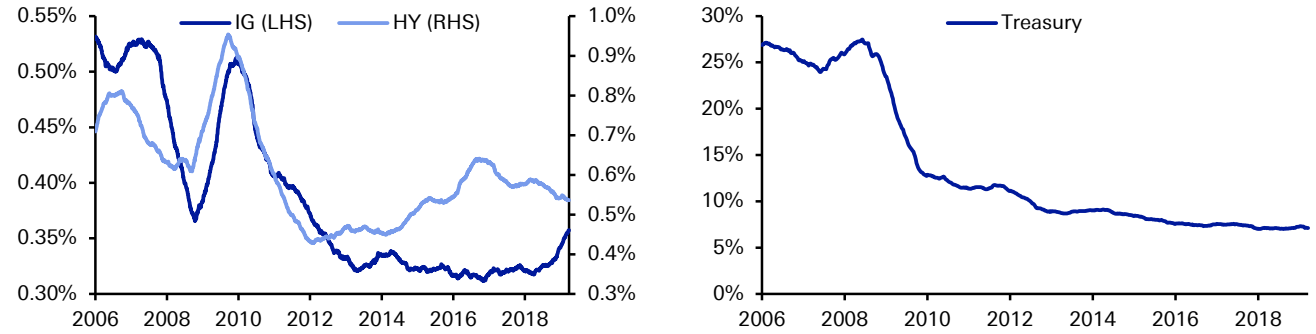
3 See HY Strategy - Changing tides for HY credit...will rising stars give way to fallen angels? (20 Nov 2018) and US Credit Strategy - BBB Super Issuers - Mind The Gap (14 Mar 2019)

Figure 41: Outstanding US Corporate Bond Market vs. US Dealers' Inventory ($bn)



Note: New inventory series since 2013, providing a more detailed split for corporate bonds.
Source: Deutsche Bank, NY Fed, Bloomberg Finance LP

Figure 42: 12 Month-Moving Average Daily Turnover as a Percentage of the Outstanding Market for US Corporate Bonds (left) and Treasuries (right)



Source: Deutsche Bank, Bloomberg Finance LP, FINRA

This size-versus-liquidity dynamic doesn't matter when the economy is growing, fundamentals are stable, and we see consistent inflows. This has been the general situation over the post GFC period bar a few mini wobbles (e.g., October-December 2018) where we have seen sharp spread reversals. These wobbles, though, have rarely been caused by concerns of an imminent recession. When the next recession does hit, we will likely see huge outflows and investors scrambling to sell to fund these outflows and also to try to protect performance. This will likely mean severe credit spread widening and a major decoupling from default risk.

So, it's quite possible the next recession will see the third-worst spread peak in history (behind only the Depression and the GFC) due to these market dynamics. However, these peaks may not last long as central banks will probably be forced to buy to ease pressure on the market. In fact, this is probably a more traditional function of central banks: to lend money to solvent entities when there is a liquidity problem. Companies are unlikely to have liquidity problems, but those holding the bond might well do.

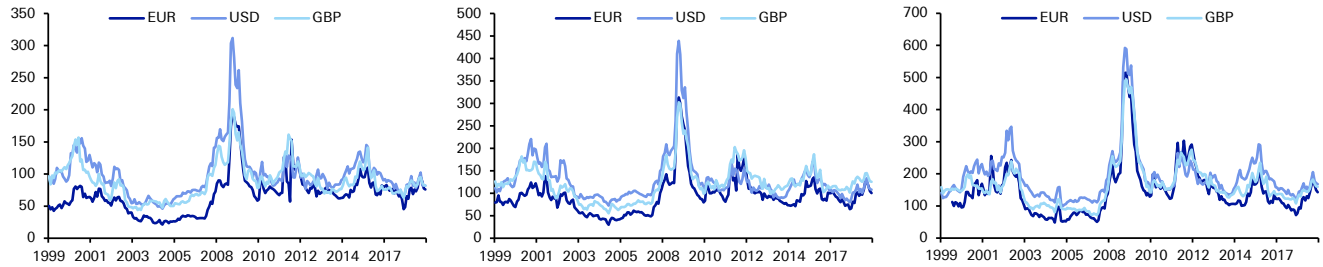
Spreads vs. defaults

This section focuses on where credit currently trades and how that compares to long-term default trends. We look at longer-term averages as well as actual default cycles by cohort to highlight the more-and-less extreme periods and not just the smoothed averages. For those who think the post 2004 era discussed at length in this piece is more representative of the near to medium-term default environment we show 'best-case' default scenarios through the remainder of this piece. Ultimately, the assessment we make is whether credit spreads are likely to compensate for historical default risk from a buy-and-hold perspective relative to the underlying government benchmark.

Non-financial (cash) default spread premiums

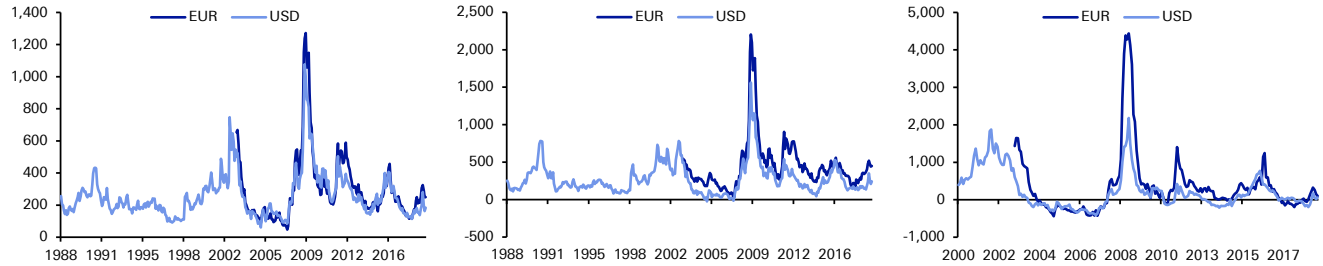
We start by looking at default spread premium[4] (DSP) histories (AA-CCC) in the USD and EUR credit markets. They are calculated by subtracting the spread required to compensate for average (historical) default rates and assuming (broadly) average recovery rates (40%). Given our earlier discussions within this note we could certainly question whether using the long-term average (based on data back to 1981) is too conservative given the structural shift lower in default rates we have already highlighted. However, looking at averages are a good place to start.

Figure 43: IG DSPs By Currency and Rating (bps) – AA (left), A (middle) and BBB (right)



Source: Deutsche Bank, Markit Group

Figure 44: HY DSPs By Currency and Rating (bps) – BB (left), B (middle) and CCC (right)



Source: Deutsche Bank, Markit Group, FactSet (ICE BAML)

4 Default spread premiums (DSP) for cash bonds calculated by subtracting the spread required to compensate for default for a given default and recovery assumption from the index spread level.

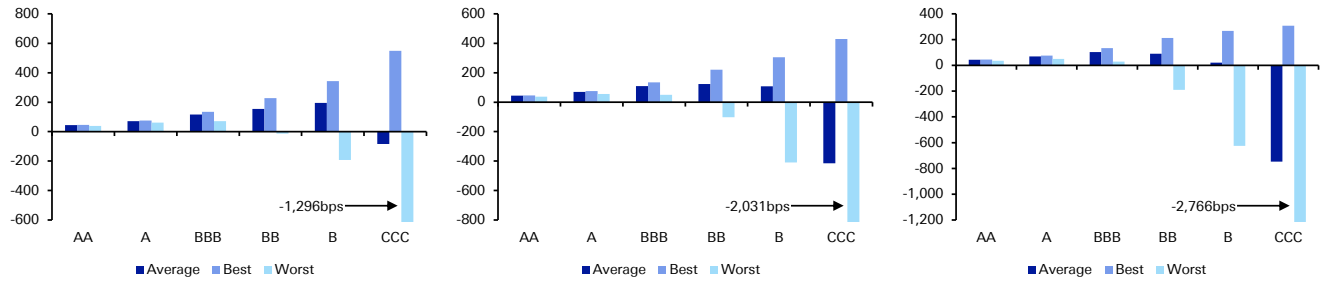
Even if we are being too aggressive with our default assumptions, the clear change relative to last year is that DSPs are generally wider, which is unsurprising given that spreads generally widened in 2018. This doesn't affect the general conclusion that IG- and BB-rated credit has always provided wider spreads than what is required to compensate for default through an average default cycle. B DSPs have also remained in positive territory since the GFC. Even at the tights in 2018, the USD B DSP remained above 130bps, and although we've clearly seen spreads tighten YTD, the current level is close to 250bps. The EUR B DSP is at even wider levels (currently just under 450bps) and only around 100bps tighter than the peaks we saw during the energy/commodity led widening (2015/2016). The story for CCCs is arguably more interesting. Last year USD CCCs had a negative DSP for much of the year, and while that recovered into positive territory during the Q4 sell-off, the current level is less than 60bps. The EUR CCC DSP also dipped into negative territory last year, and although it widened to more than 300bps in Q4, it is now back below 100bps.

We now take a closer look at the current situation, considering different default and recovery scenarios. This analysis is based around the five-year maturity point (focused on bonds with 4-6 years to maturity). In addition to average default cycles, we also consider the worst historical cycle as well as the most benign, which is appropriate if you believe the post 2004 world continues. Furthermore, we introduce additional recovery assumptions (0% and 20% in addition to 40%). This framework essentially tries to assess the most attractive default-adjusted spread from a buy-and-hold perspective.

We start by looking at USD credit in Figure 45 and provide some of the key highlights below.

- Based on an average default cycle and 40% recovery Bs offer the widest DSP. However as we lower the recovery assumption this shifts to BBs at 20% and BBBs at 0%. In fact, with a 0% recovery AA and A DSPs are wider than the B DSP.
- Whilst CCC DSPs would be the widest (across ratings) in a benign default scenario, they do not even provide a positive DSP when we assume an average default cycle and 40% recovery.
- If we look at the most extreme default scenario, HY DSPs are negative for all recovery assumptions. For IG they remain positive for all recovery assumptions. The A DSP is wider than the BBB DSP as we lower the recovery assumption.

Figure 45: USD Non-Financial Default Spread Premiums for Average, Best (lowest) and Worst (highest) 5-year Cumulative Default Observations Assuming 40% (left), 20% (middle) and 0% (right) Recoveries

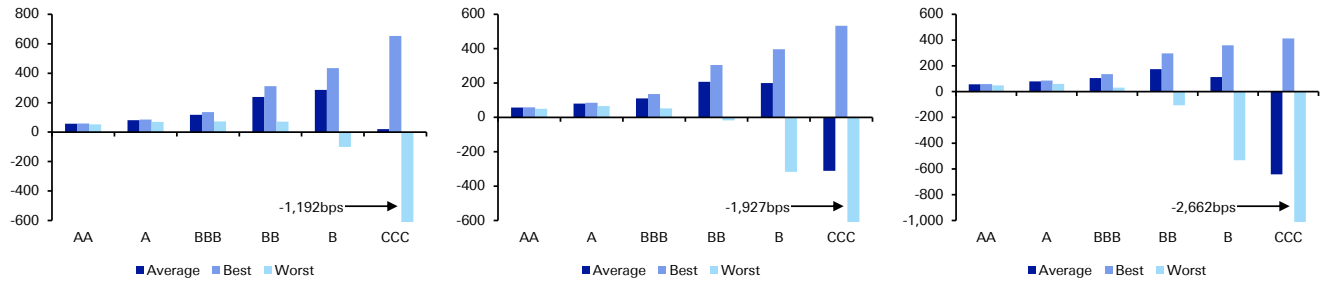


Source: Deutsche Bank

Figure 46 looks at the results for the EUR market where, broadly speaking, the conclusions are similar. We provide the highlights below.

- Bs provide the widest DSP, assuming an average default cycle and 40% recovery. This shifts to BBs as we lower the recovery assumption.
- Excluding the benign scenario, when CCCs provide the widest DSPs for all recovery assumptions, the CCC DSP is only positive assuming an average default cycle and 40% recovery.
- For the most extreme default scenario BBBs provide the widest DSP assuming a 40% recovery, but this shifts to As as we lower the recovery assumption. For HY only BBs assuming an average default cycle and 40% recovery provide a positive DSP.

Figure 46: EUR Non-Financial Default Spread Premiums for Average, Best (lowest) and Worst (highest) 5-year Cumulative Default Observations Assuming 40% (left), 20% (middle) and 0% (right) Recoveries



Source: Deutsche Bank

Given our earlier assertions that default rates may have shifted structurally, then our assumptions for average defaults might be too conservative, and we could see a situation where the average henceforth is lower than our historical numbers. Under such a scenario, our analysis suggests HY credit should outperform IG on a buy-and-hold basis. If we were to see a better than long-term average default cycle, that would probably favour Bs over BBs, although this might be challenged, if we expect lower recoveries. It's very difficult to make an argument for CCCs at this level, unless the view is that defaults are about as benign as they have ever been. If we are to see a more aggressive default cycle play out, then we would expect IG credit to outperform from this starting point.

Cohort analysis

In this sub-section we update our analysis assessing what's priced in to current spreads by comparing them to the spreads that would have been required to compensate for default based on all realised 5-year cohorts over the last 30+ years using different recovery assumptions. We look at this on a global basis but also show the analysis for European cohorts.

Global cohorts

We start by looking at defaults globally with the analysis based only on nonfinancial issuers. We calculate spreads required to compensate for default based on each actual 5-year discreet cohort formed since 1981 (based on S&P data). Overall, this analysis is useful for showing where current spreads are across the board and in which periods through history these spreads would have (and would not have) compensated for the risk of default and by how much. We use both 40% and 0% recoveries, as exact recoveries by cohort are not available. This provides us with a compensation range if readers want to estimate for a different recovery rate.

In Figure 48 we show the spread required to compensate for each historical cohort across both IG and HY rating bands. We have drawn a box around each cell where the spread required to compensate for default is wider than the tightest current spreads (as shown in Figure 47) of the relevant rating band across the currencies (USD, EUR, GBP).

Figure 47: Non-Financial Spreads (vs. Governments) by Rating (bps)

	Currency	IG	AA	A	BBB	HY	BB	B	CCC
Current	EUR	134	78	105	163	442	346	703	1,038
	USD	154	84	115	189	418	279	496	868
	GBP	155	84	134	182	458	376	585	
Wide since 2007	EUR	380	195	321	548	1,927	1,401	2,459	6,160
	USD	524	320	460	650	1,660	1,234	1,825	2,992
	GBP	360	205	315	542				
Tight since 2007	EUR	59	24	52	70	212	142	260	475
	USD	111	65	86	128	258	178	239	395
	GBP	84	65	83	93				

Source: Deutsche Bank, Markit Group

The IG analysis (as usual) provides very little of interest. As is usually the case, current spread levels across all IG ratings are wider than the spread to compensate for each of the past 5-year default cycles, even when we assume 0% recoveries. In fact, at the tights it's only BBBs (and mainly in EUR) that would have failed to exceed all past cohort compensation levels.

The HY market provides us with the more interesting observations. The 5-year cumulative default rates for the latest cohorts are broadly unchanged from the previous year. For BBs, they are exactly the same (3.8%), while for Bs the 5-year default rate has edged up marginally (14.0% vs. 13.7%). So, from a historical perspective default rates remain very low, and this leaves the spread required to compensate for default for BBs (46-77bps) and Bs (182-304bps) well below current spread levels across all currencies.

With spreads notably wider than they were a year ago, there are now no BB cohorts where the spread required to compensate for default is wider than current spreads, when assuming a 40% recovery and in only 7 of the 34 cohorts is this the case if we assume a 0% recovery. None of the cohorts formed in our period of

structurally lower default rates (since 2004) has required a wider compensation spread than current levels even with a 0% recovery.

For Bs there are only 4 cohorts (formed from 1998 to 2001) where the spread required to compensate for default (assuming a 40% recovery) was higher than current spreads. In fact, for current EUR B spreads there are no such cohorts. When we lower the recovery assumption to 0%, then 15 of the 34 cohorts required higher compensation levels than current spreads. Only two (2008 and 2009) of those have occurred since 2003, and again for EUR Bs, current spreads would be wider than all cohorts since 2003.

We finish by looking at CCCs where the latest 5-year cohort dropped slightly (41.3% vs. 46.8%). Despite the drop in the default rate the spread required to compensate for this latest 5 year default rate is wider than current CCC spreads when we assume a 0% recovery. In fact, based on this analysis every cohort formed since 1997 required a wider spread than current levels, when assuming a 0% recovery. Even when we assume a 40% recovery, only 6 of the 18 cohorts formed since 1997 have required a lower compensation spread, but that does include the most recent cohort.

Figure 48:Spreads Required to Compensate for Default Based on Global 5-year Cumulative Default Rates by Cohort. Boxed numbers show past 5-year default periods where current spreads would not compensate for eventual default risk.

	40% Recovery								0% Recovery							
	IG	AA	A	BBB	HY	BB	B	CCC	IG	AA	A	BBB	HY	BB	B	CCC
1981	8	0	3	24	165	164	189		13	0	4	40	274	274	315	
1982	11	0	8	27	232	221	225	471	19	0	14	44	386	369	375	784
1983	11	6	3	30	209	176	208	655	19	10	5	50	349	293	347	1,091
1984	10	5	3	27	260	174	313	750	16	8	5	45	433	290	522	1,250
1985	6	5	5	10	267	159	377	360	10	8	9	16	445	265	628	600
1986	13	5	8	32	241	105	337	631	21	8	13	53	401	174	561	1,052
1987	22	5	15	51	274	142	286	921	36	8	24	85	457	236	477	1,535
1988	15	5	10	34	306	151	351	923	25	8	16	56	509	252	585	1,538
1989	10	0	0	35	352	185	403	1,108	17	0	0	59	587	308	672	1,846
1990	8	0	0	26	355	148	436	1,630	13	0	0	43	591	247	726	2,717
1991	5	0	3	13	278	71	367	1,031	9	0	5	22	463	118	611	1,719
1992	2	0	3	4	150	25	208	657	4	0	5	7	249	41	347	1,095
1993	2	0	3	3	133	50	198	462	4	0	5	6	222	83	330	769
1994	3	0	3	7	137	58	198	772	6	0	5	11	228	96	330	1,286
1995	8	0	0	21	144	85	174	831	13	0	0	35	240	142	290	1,385
1996	8	0	3	18	170	91	245	404	13	0	4	30	283	151	408	674
1997	15	0	7	29	263	140	370	1,292	25	0	12	48	439	234	616	2,154
1998	31	0	13	58	397	219	543	1,698	52	0	22	96	661	365	904	2,830
1999	32	0	13	60	491	264	648	1,891	54	0	21	100	819	441	1,080	3,152
2000	33	0	15	58	477	240	624	1,956	55	0	25	96	795	400	1,041	3,261
2001	36	0	10	63	446	208	566	2,205	60	0	17	105	744	347	944	3,675
2002	19	0	0	36	313	114	360	1,512	32	0	0	60	522	189	600	2,519
2003	4	0	0	8	164	50	165	1,000	7	0	0	13	274	83	274	1,667
2004	6	0	2	9	104	44	113	542	9	0	3	15	174	73	188	904
2005	13	0	2	23	157	85	193	542	22	0	3	38	262	141	321	903
2006	8	0	2	13	189	83	239	745	13	0	3	21	314	138	398	1,241
2007	6	0	0	10	218	92	279	925	9	0	0	17	363	154	465	1,542
2008	5	0	0	8	266	84	352	1,677	8	0	0	13	443	140	587	2,795
2009	1	0	0	1	263	48	300	2,017	1	0	0	2	438	81	500	3,361
2010	0	0	0	0	125	23	115	649	0	0	0	0	208	38	191	1,081
2011	1	0	2	0	121	38	134	763	1	0	4	0	202	63	223	1,272
2012	4	0	2	5	142	60	145	1,015	6	0	4	8	237	101	242	1,692
2013	2	0	0	3	156	46	178	933	4	0	0	6	261	77	296	1,555
2014	4	0	0	7	154	46	182	769	7	0	0	11	257	77	304	1,282

Source:Deutsche Bank, S&P

European cohorts

Given that the global data is heavily biased towards the US, in Figure 49 we look at the spreads required to compensate for default for European issuers by cohort. Again, we put a box around the cells where the required spread is wider than the current EUR spreads for the appropriate rating.

With HY default rates for the latest cohort lower across all rating bands the latest compensation levels are tighter than current spreads for all ratings. When assuming a 40% recovery, only the 1999 cohort required wider spreads for both BBs and Bs, and that's true only for Bs for the 2001 cohort. All other cohorts have required tighter than current spreads to compensate for default. When we lower the recovery assumption to 0%, then every BB and B cohort formed since 2003 has required a tighter spread than current levels to compensate for default. The period prior to this was very much in the infancy of European HY credit, when default rates were hampered by a lack of market diversification. CCCs is a very small subset of European issuers, but 7 of the 14 cohorts have required a wider spread than current levels to compensate for default when assuming a 40% recovery and 10 of 14 when we assume a 0% recovery.

Figure 49:Spreads Required to Compensate for Default Based on European 5-year Cumulative Default Rates by Cohort. Boxed numbers show past 5-year default periods where current spreads would not compensate for eventual default risk.

	40% Recovery								0% Recovery							
	IG	AA	A	BBB	HY	BB	B	CCC	IG	AA	A	BBB	HY	BB	B	CCC
1999	17	0	13	52	626	383	818		28	0	21	86	1,044	638	1,364	
2000	29	0	22	71	513	313	623		48	0	37	118	855	522	1,039	
2001	29	0	10	72	650	312	945	3,600	48	0	16	121	1,084	519	1,575	6,000
2002	17	0	0	44	408	210	496	3,600	29	0	0	74	681	350	827	6,000
2003	3	0	0	9	168	68	118	2,400	6	0	0	14	280	113	197	4,001
2004	3	0	0	8	92	36	99	1,200	6	0	0	14	154	60	165	2,000
2005	7	0	0	16	81	30	131	400	11	0	0	26	136	51	218	667
2006	3	0	0	8	110	16	173	923	6	0	0	13	184	26	289	1,538
2007	3	0	0	7	159	69	212	1,000	6	0	0	12	266	114	353	1,667
2008	3	0	0	7	234	118	332	2,000	5	0	0	12	389	197	554	3,334
2009	0	0	0	0	229	89	266	1,750	0	0	0	0	382	148	444	2,917
2010	0	0	0	0	124	37	199	88	0	0	0	0	207	61	332	147
2011	0	0	0	0	144	15	210	400	0	0	0	0	240	26	351	667
2012	0	0	0	0	138	40	140	857	0	0	0	0	231	67	233	1,429
2013	0	0	0	0	125	38	122	1,200	0	0	0	0	209	64	203	2,000
2014	0	0	0	0	84	41	90	340	0	0	0	0	140	69	150	566

Source:Deutsche Bank, S&P

Overall, this analysis backs up what we have already shown with our DSP analysis. With spreads having widened over the past 12 months and no deterioration in default rates, credit doesn't look too expensive. This would be particularly true if we remain in a world of structurally lower default rates as we've seen for the past 15 years (per our earlier analysis). Nonetheless, on a buy-and-hold basis, we would argue CCCs still look vulnerable over the course of the cycle, even if we see below average defaults.

Non-financial (cash) spread implied default rates

So far we have focused on whether current spread levels compensate for default risk; in this sub-section we assess what level of default rate is priced into current spreads. We do this by calculating spread-implied default rates. Before we look at the results of this analysis, we provide a brief description of our methodology. The analysis focuses on non-financials around the 5-year tenor. To achieve this,we

include all senior bonds with 4-6 years until maturity within the iBoxx indices. Having calculated average spreads for our sample bond sets, we use three different recovery assumptions (0%, 20% and 40%) to calculate implied default rates. We compare these default rates with an appropriate average five-year cumulative global default rate as well as the worst five-year periods observed since 1981. We also provide the average and worst five-year level for the primary region of the various bond markets (Europe – EUR; UK – GBP; US – USD). We have highlighted the cells where the implied default rate is lower than the average experience (darker blue) as well as those where the implied default rate is lower than the worst but higher than the average (lighter blue). The shading is based only on the historical global default rates.

Broadly speaking, this analysis confirms much of what we have already shown. For IG ratings across all recovery assumptions and all currency markets the level of defaults implied by current spread levels is higher than any historical observations. For HY this analysis once again highlights the potential risks of owning CCC risk as a buy-and-hold investor. For both EUR and USD CCCs the implied default rate is lower than the worst observation, when we assume a recovery of 20% or lower. With the exception of EUR BB spreads assuming a 40% recovery all other HY implied default rates sit between the long-term historical average and the worst observation.

Figure 50: Non-Financial 5-year Cumulative Spread Implied Default Rates Based on Different Recovery Assumptions

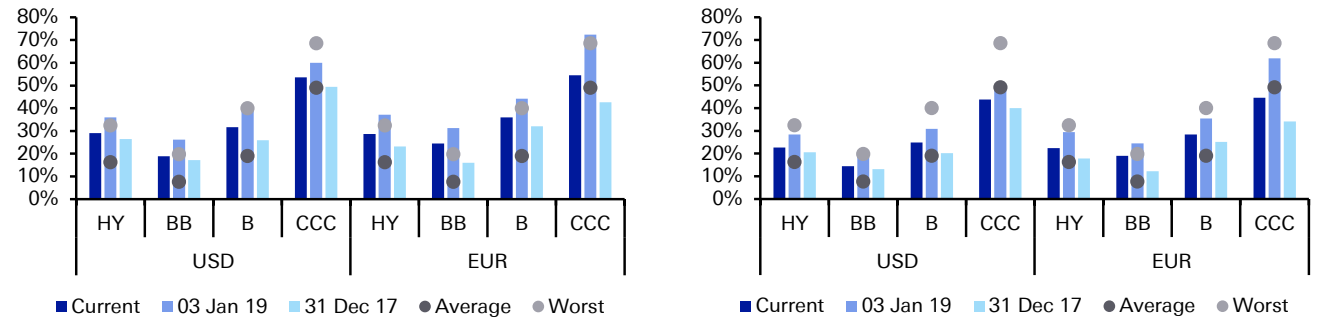
			Implied 5yr Cumulative Default Rate			Actual Average 5yr Cumulative Default Rates			
						Global		Regional	
		5yr Spread	0% Recovery	20% Recovery	40% Recovery	Worst	Average	Worst	Average
EUR	IG All	116	5.7%	7.0%	9.2%	2.9%	0.9%	2.4%	0.4%
	AA	59	2.9%	3.6%	4.8%	0.5%	0.1%	0.0%	0.0%
	A	85	4.2%	5.2%	6.9%	1.2%	0.3%	1.8%	0.2%
	BBB	136	6.5%	8.1%	10.7%	5.1%	1.6%	5.8%	0.8%
	HY All	407	18.4%	22.4%	28.7%	32.5%	16.3%	38.8%	11.5%
	BB	335	15.5%	19.0%	24.5%	19.8%	7.7%	27.3%	5.0%
	B	547	23.4%	28.4%	35.9%	40.0%	19.1%	47.6%	13.4%
	CCC	1,013	37.6%	44.6%	54.4%	68.5%	49.1%	75.0%	38.4%
GBP	IG All	139	6.8%	8.4%	11.1%	2.9%	0.9%	3.7%	0.5%
	AA	44	2.2%	2.8%	3.7%	0.5%	0.1%	0.0%	0.0%
	A	86	4.2%	5.2%	6.9%	1.2%	0.3%	3.3%	0.4%
	BBB	161	7.9%	9.7%	12.7%	5.1%	1.6%	7.3%	0.8%
USD	IG All	107	5.1%	6.4%	8.4%	2.9%	0.9%	2.4%	0.9%
	AA	45	2.2%	2.7%	3.6%	0.5%	0.1%	0.5%	0.2%
	A	76	3.6%	4.5%	6.0%	1.2%	0.3%	1.3%	0.4%
	BBB	134	6.4%	8.0%	10.5%	5.1%	1.6%	4.2%	1.6%
	HY All	411	18.6%	22.7%	29.0%	32.5%	16.3%	30.9%	17.0%
	BB	251	11.8%	14.5%	18.8%	19.8%	7.7%	17.3%	8.0%
	B	455	20.4%	24.8%	31.7%	40.0%	19.1%	38.4%	19.2%
	CCC	908	36.9%	43.7%	53.5%	68.5%	49.1%	72.5%	51.1%

Source: Deutsche Bank, Markit Group, S&P

These implied levels of default are higher than they were a year ago, but, as we can see in Figure 51 , a lot lower than they were at the start of this year, when spreads were at their most recent wides. We have additionally compared these levels with the long-term average and worst default observations. We can see that for EUR HY when assuming a 40% recovery, implied default rates across all ratings were higher than the worst observations with the same true for USD HY with the exception of CCCs. So, although spread implied default rates are higher than they were a year ago, it's clear they are a lot lower than they were just a few months ago. In line with much of the analysis looking at current spreads, we

would only really be concerned about credit at current spread levels if we see default levels above the long-term average levels.

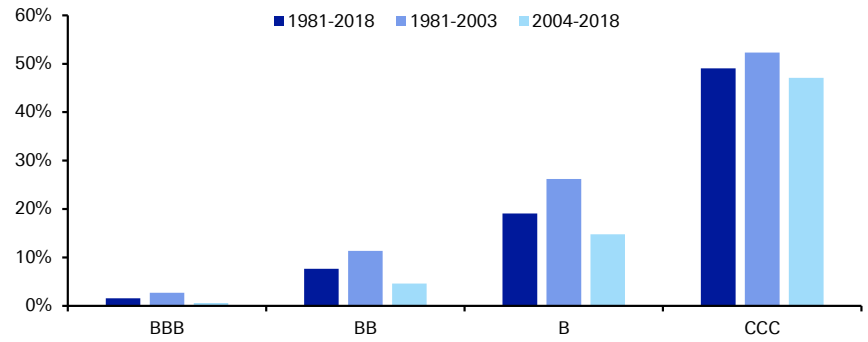
Figure 51: Spread Implied 5-yr Cumulative Default Rates Compared to Long-Term Average and Worst Observations - Assuming 40% (left) and 20% (right) Recoveries



Source: Deutsche Bank, S&P

We see this as unlikely in a world of low real yields that has likely helped to push default rates structurally lower over the past 15 years. In fact, in Figure 52 we compare the long-term average 5-year cumulative default rates with the averages for the period up until the end of 2003 and the period since then. For BBs and Bs, this drops the average level by more than 3pp and 4pp, respectively. This only further emphasizes the potential value in credit markets if default rates are expected to remain structurally lower.

Figure 52: Average Global 5-Year Cumulative Default Rates for Different Periods



Source: Deutsche Bank, S&P

The CDS market

In this final sub-section, we switch the focus to the CDS market. We calculate the level of default implied by current spread levels as well as the DSP for the key CDS indices. Essentially, we repeat much of the analysis we have already done for the cash market. Rather than focusing purely on the 5-year tenor, we actually look at the various CDS indices (iTraxx and CDX) and calculate implied cumulative default rates across the term structure assuming different recovery levels. We then compare them with a rating implied default rate. To do this we have examined the rating breakdown of each index, looking at the issuer rating (not issue rating) for each constituent, and then using average cumulative default

rate data from S&P, we have calculated an average cumulative default probability based on the appropriate tenor. When assessing the rating for each issuer, we have used the average rating from Moody's, S&P and Fitch (where available). For unrated issuers we have assumed the average HY cumulative default rate.

We have calculated DSPs for each index by taking the rating implied default rate and calculating the spread required to compensate for default assuming different recoveries and subtracting this from the actual trading level of the index. In addition, we show the spread implied default count, which is simply calculated by multiplying the spread implied default rate with the number of constituents in the index.

We show the results in Figure 53 and we have specifically shaded the cells where the spread implied default rate is lower than the rating implied rate and where the DSP is therefore negative. Essentially the highlighted cells show us where the longer-term buy-and-hold investor is not being compensated for the risk of average defaults over the tenor of the index.

In general, spreads are wider than where they were a year ago, most notably for CDX HY. Also, the rating-implied default rates for the HY indices are lower than where they were a year ago, helped by an improvement in the average rating of the index. This is particularly true for iTraxx Crossover, where the average rating is now around half a notch higher. As much of the analysis so far has highlighted, IG spreads imply default rates higher than average levels or in this case the rating-implied levels for all analysed scenarios. This is also now true for CDX HY as spreads have tightened, and we've seen a marginal improvement in the average rating. Howeve,r for iTraxx Crossover the implied default rate over 3 years is actually lower than the rating implied rate when assuming a recovery of 20% or lower. This is also the case at the 5-year tenor when assuming a 0% recovery.

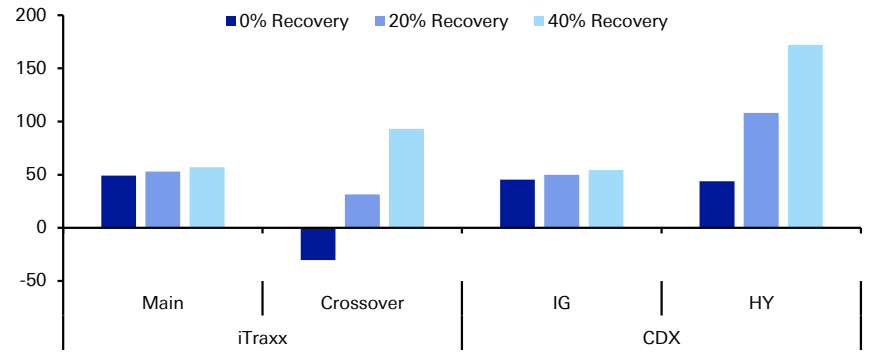
Figure 53:CDS Index Spread and Rating Implied Default Rates/Count and Default Spread Premium

						Spread Implied Cumulative DRs			Default Spread Premium (bps)			Spread Implied Cumulative Default Count		
Index Family	Index	Average Rating	Tenor	Rating Implied Default Rate	Spread	0% Recovery	20% Recovery	40% Recovery	0% Recovery	20% Recovery	40% Recovery	0% Recovery	20% Recovery	40% Recovery
iTraxx	Main	A3-Baa1	3yr	0.3%	37	1.2%	1.5%	2.0%	29	31	32	1.5	1.9	2.5
			5yr	1.0%	68	3.5%	4.4%	5.8%	49	53	57	4.4	5.5	7.2
			7yr	1.3%	92	6.4%	8.0%	10.5%	74	77	81	8.0	9.9	13.1
			10yr	2.1%	111	10.8%	13.3%	17.3%	91	95	99	13.5	16.6	21.6
	Fin Sen	A2-A3	5yr	0.5%	84	4.3%	5.4%	7.1%	74	76	78	1.3	1.6	2.1
			10yr	1.3%	121	11.7%	14.4%	18.7%	109	111	114	3.5	4.3	5.6
	Fin Sub	Baa1-Baa2	5yr	1.5%	169	8.5%	10.5%	13.7%	140	146	152	2.5	3.1	4.1
			10yr	3.0%	171	16.0%	19.6%	25.3%	141	147	153	4.8	5.9	7.6
	Crossover	Ba3-B1	3yr	7.8%	191	6.0%	7.4%	9.8%	-60	-10	40	4.5	5.6	7.3
			5yr	14.9%	278	13.6%	16.6%	21.6%	-30	31	93	10.2	12.5	16.2
			7yr	16.5%	326	21.0%	25.5%	32.5%	77	127	177	15.8	19.2	24.4
			10yr	19.7%	344	29.7%	35.6%	44.4%	129	172	215	22.3	26.7	33.3
CDX	IG	Baa1-Baa2	3yr	0.3%	38	1.2%	1.5%	2.0%	28	30	32	1.5	1.9	2.6
			5yr	1.2%	68	3.5%	4.4%	5.8%	45	50	54	4.4	5.5	7.2
			7yr	1.5%	93	6.5%	8.0%	10.6%	71	75	80	8.1	10.0	13.2
			10yr	2.5%	114	11.0%	13.5%	17.6%	89	94	99	13.7	16.9	22.0
	HY	Ba3-B1	3yr	8.3%	279	8.6%	10.6%	13.9%	9	63	117	8.6	10.6	13.9
			5yr	15.5%	365	17.4%	21.2%	27.2%	44	108	172	17.4	21.2	27.2
			7yr	17.1%	403	25.3%	30.5%	38.5%	144	196	248	25.3	30.5	38.5
			10yr	20.5%	420	34.9%	41.6%	51.2%	196	241	286	34.9	41.6	51.2

Source:Deutsche Bank Markit Group

We now look at DSPs, which probably provide a better way of assessing relative value (from a buy-and-hold perspective). Although given the changes made to the Fin Senior index and the fact that there is very limited trading in the Fin Sub index, we don't think this analysis is the best way of assessing relative value for the Fin indices. Therefore, in Figure 54 we focus on iTraxx Main and Crossover as well as CDX IG and HY. CDX HY provides the widest DSP unless we assume a 0% recovery when both iTraxx Main and CDX IG provide slightly wider DSPs. iTraxx Crossover provides a wider DSP than the IG indices when we assume a 40% recovery, but when we lower the recovery, then the IG DSPs are wider with the Crossover DSP negative at a 0% recovery. On this basis, we would argue the CDX HY index looks the most attractive, offering a DSP nearly 80bps wider than the next widest index DSP with a 40% recovery and still more than 50bps when we lower the recovery to 20%.

Figure 54: Benchmark iTraxx and CDX Index 5 Year DSPs Assuming Different Recoveries



Source: Deutsche Bank

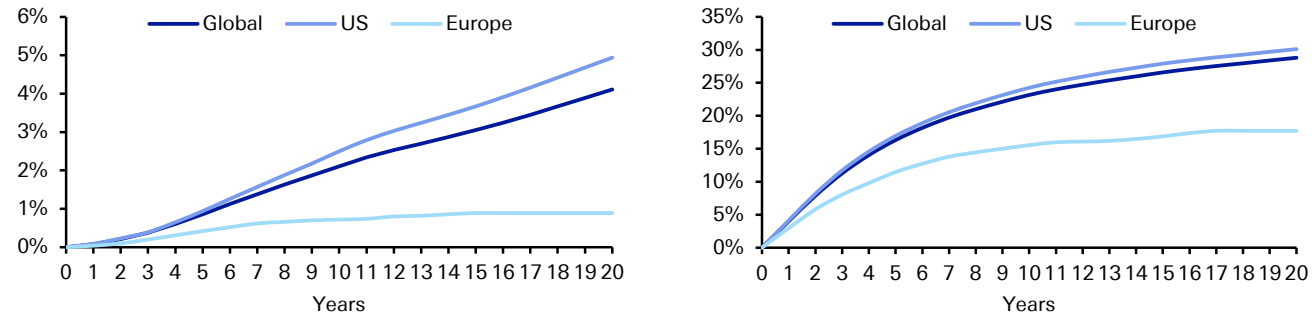
Appendix – Methodology, raw data and calculations

Now we have gone through the conclusions, we will spend a little time going through the methodology and the raw data. The spread required to compensate for default is calculated using the expected loss for each rating band given historical default and different assumed recoveries. The starting point for such calculations is the rating agencies' historical databases on default. For the purposes of this report we have mainly used data from S&P, as it provides us the flexibility to focus purely on non-financial defaults as well as looking at defaults regionally, although much of our analysis focuses on the global numbers.

US vs. Europe cumulative default rates

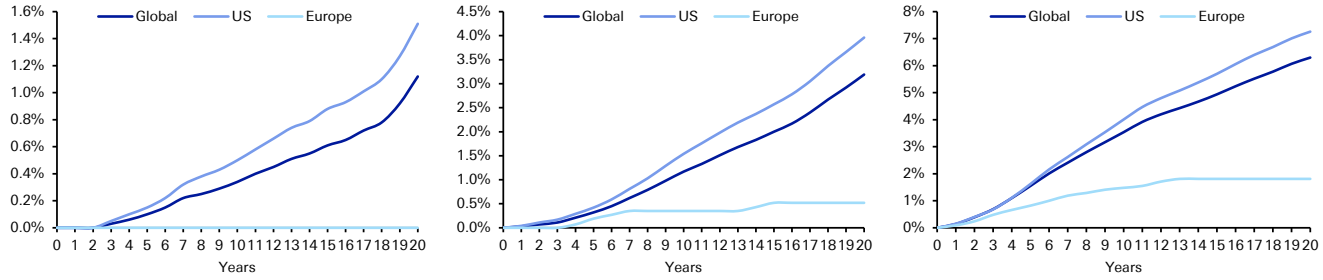
In Figure 55 - Figure 57 we show a number of charts comparing cumulative default rates for European issuers with those of US issuers. The main point here is that, in general, average historical European default rates have been lower. This is probably in large part due to the fact there is not so much history for rated European issuers. Based on the S&P database, there has only been more than 100 European IG rated issuers since 1995, and for HY there has only been more than 100 since 2004. Therefore, most of the relevant data for Europe occurs during the past decade or so of extremely low defaults, which probably helps explain the lower default rates relative to the more developed US market. This is also why we have focused on the global numbers for much of our analysis.

Figure 55: S&P Average Cumulative IG (left) and HY (right) Default Rates



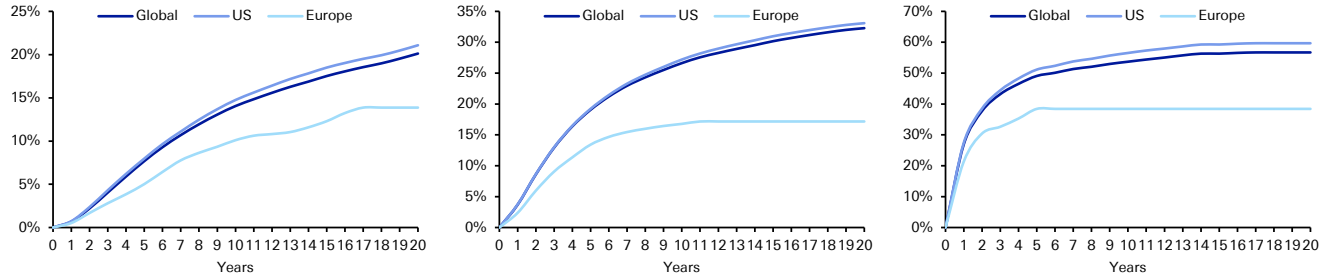
Source: Deutsche Bank, S&P

Figure 56: S&P Average Cumulative AA (left) A (middle) and BBB (right) Default Rates



Source: Deutsche Bank, S&P

Figure 57: S&P Average Cumulative BB (left) B (middle) and CCC (right) Default Rates



Source: Deutsche Bank, S&P

Calculating spreads required to compensate for default

The spreads calculated are spreads based on the maturity of the indices. That would imply we need to calculate the spreads required to compensate for cumulative default probabilities over that time period. The formula we use assumes constant instantaneous hazard rate, which is determined by the spread to that maturity. We then integrate the continuously compounded survival probability to get the cumulative survival probability over time. Thus, the formula can be used to calculate the spread from cumulative default probability or vice versa. We get the cumulative default probabilities from the S&P database and calculate the compensation spreads from them.

$$D = 1 - e^{-ST/(1-R)}$$

where D is the cumulative default probability over time T and S is the Spread to that maturity and R is the recovery

Solving for spread S,

$$S = -\frac{(1-R)}{T}\ln(1-D)$$

Some of our analysis uses different calculations where it makes more sense to look at the path of defaults, rather than simply assuming a constant instantaneous hazard rate.

Recovery rates

In terms of recovery, we have used a selection of different rates throughout the note, generally focusing on 0%, 20% and 40%. However, in Figure 58 (for comparison purposes) we publish a table showing average senior unsecured recovery rates for different rating bands. Recovery rates can fluctuate depending on different macroeconomic backdrops, which is why we include the range of recovery scenarios. Recoveries are a very important factor when trying to assess losses in the case of default and therefore calculate the spread required to compensate for default.

Figure 58: Moody's Senior Unsecured Recovery Rates by Rating (1983-2018)

	Year 1	Year 2	Year 3	Year 4	Year 5	Average
Aa	37.2%	39.0%	38.1%	44.0%	43.2%	40.3%
A	30.4%	42.6%	45.0%	44.5%	44.2%	41.3%
Baa	42.9%	44.2%	44.0%	43.9%	43.6%	43.7%
Ba	44.6%	43.3%	42.2%	41.8%	41.9%	42.8%
B	37.7%	36.9%	37.4%	37.9%	38.6%	37.7%
Caa-C	38.6%	39.0%	39.1%	39.5%	39.7%	39.2%
IG	40.0%	43.3%	44.0%	44.2%	43.9%	43.1%
HY	38.7%	38.6%	38.7%	39.1%	39.5%	38.9%
All	38.7%	38.8%	39.1%	39.5%	39.9%	39.2%

Source: Moody's

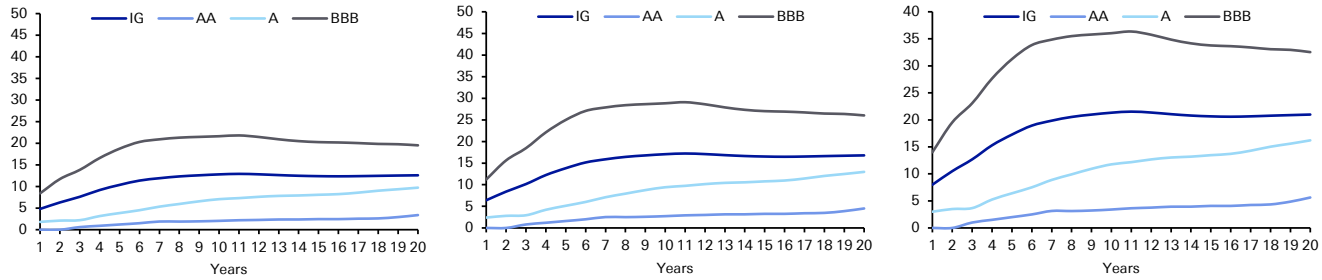
Spreads required to compensate for default

Figure 59: Spreads Required to Compensate for Default Assuming Different Recovery Levels

	40% Recovery								20% Recovery								0% Recovery							
Years	IG	AA	A	BBB	HY	BB	B	CCC	IG	AA	A	BBB	HY	BB	B	CCC	IG	AA	A	BBB	HY	BB	B	CCC
1	5	0	2	8	246	41	226	1,883	6	0	2	11	327	55	301	2,511	8	0	3	14	409	68	376	3,139
2	6	0	2	12	247	67	270	1,421	8	0	3	16	329	89	360	1,894	11	0	4	20	411	112	450	2,368
3	8	1	2	14	239	83	277	1,131	10	1	3	18	319	110	370	1,508	13	1	4	23	399	138	462	1,885
4	9	1	3	17	227	91	269	939	12	1	4	22	303	122	358	1,252	15	2	5	28	378	152	448	1,565
5	10	1	4	19	214	96	254	810	14	2	5	25	285	128	339	1,080	17	2	6	31	356	160	423	1,350
6	11	2	5	20	201	98	238	695	15	2	6	27	267	130	318	927	19	3	8	34	334	163	397	1,159
7	12	2	5	21	188	97	224	617	16	3	7	28	251	129	298	823	20	3	9	35	314	162	373	1,029
8	12	2	6	21	177	95	209	551	16	3	8	28	236	127	279	735	21	3	10	35	295	159	348	919
9	13	2	7	21	167	93	196	503	17	3	9	29	222	124	262	671	21	3	11	36	278	156	327	838
10	13	2	7	22	158	91	186	462	17	3	9	29	211	121	248	616	21	3	12	36	263	151	310	770
11	13	2	7	22	150	88	176	428	17	3	10	29	200	117	234	571	22	4	12	36	250	146	293	714
12	13	2	8	21	142	85	166	400	17	3	10	29	189	113	222	533	21	4	13	36	237	141	277	666
13	13	2	8	21	135	82	158	376	17	3	10	28	180	109	210	502	21	4	13	35	225	137	263	627
14	12	2	8	20	129	79	150	355	17	3	11	27	172	106	200	473	21	4	13	34	215	132	250	591
15	12	2	8	20	124	77	144	331	17	3	11	27	165	103	192	442	21	4	13	34	206	128	239	552
16	12	2	8	20	118	75	137	313	16	3	11	27	158	100	183	417	21	4	14	34	197	124	229	521
17	12	3	9	20	114	72	132	295	17	3	11	27	152	97	176	394	21	4	14	33	190	121	220	492
18	12	3	9	20	109	70	127	279	17	3	12	26	146	94	169	372	21	4	15	33	182	117	211	465
19	13	3	9	20	105	69	122	264	17	4	12	26	141	91	162	352	21	5	16	33	176	114	203	441
20	13	3	10	20	102	67	117	251	17	5	13	26	136	90	156	335	21	6	16	33	170	112	195	419

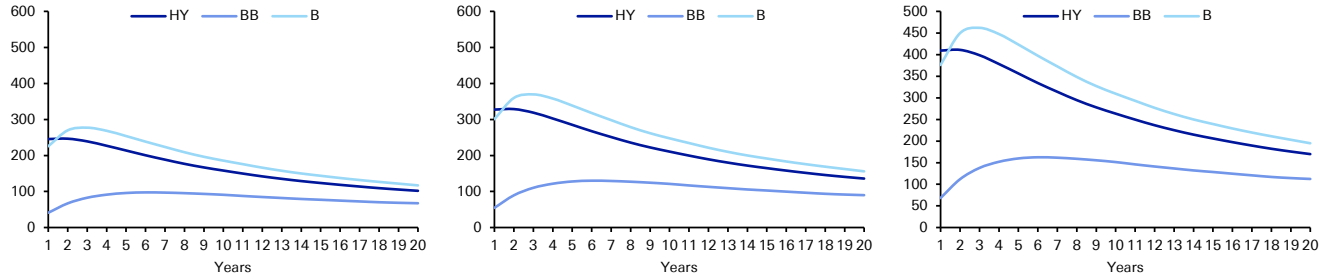
Source: Deutsche Bank, S&P

Figure 60: IG Spread Required to Compensate for Default Assuming a 40% (left), 20% (middle), 0% (right) Recovery



Source: Deutsche Bank, S&P

Figure 61: HY Spread Required to Compensate for Default Assuming a 40% (left), 20% (middle), 0% (right) Recovery



Source: Deutsche Bank, S&P

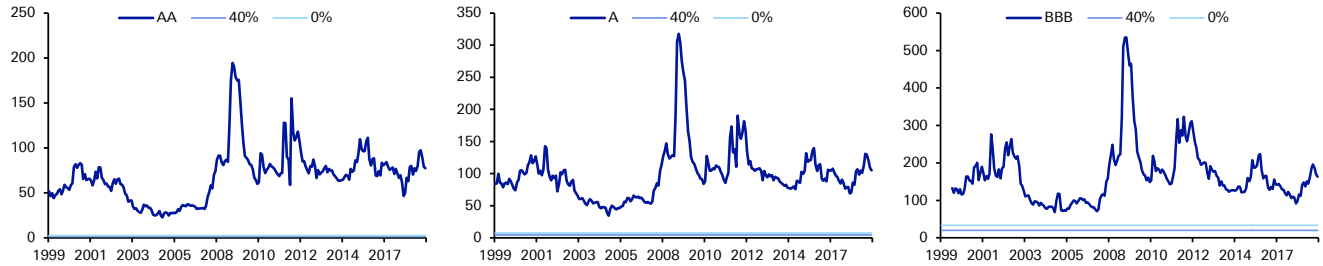
Credit spreads vs. spreads required to compensate for default

Whilst we have formed most of our conclusions in earlier sections of this note, the following section takes a more detailed graphical look at the spreads required to compensate for default probability assuming different recovery rates against historical index level spreads. We also include here a fuller compilation of default spread premium charts.

The charts focus on non-financial indices across the rating bands. We include charts for the EUR, USD, and GBP markets for IG and EUR and USD for the HY market. We initially show the spread histories compared with the spread required to compensate for average historical default based on the appropriate rating and index average life, assuming both a 40% and 0% recovery. We then show the DSP charts where we subtract the spread required to compensate for default from the actual trading levels. For this we only use the analysis where we assume a 40% recovery.

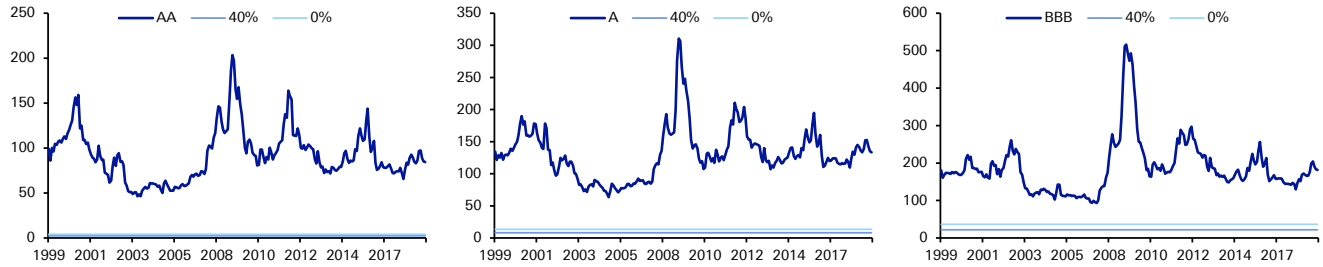
Investment Grade

Figure 62: EUR AA (left), A (middle) and BBB (right) Index Spread Histories vs. Default-Compensation Spreads (bps)



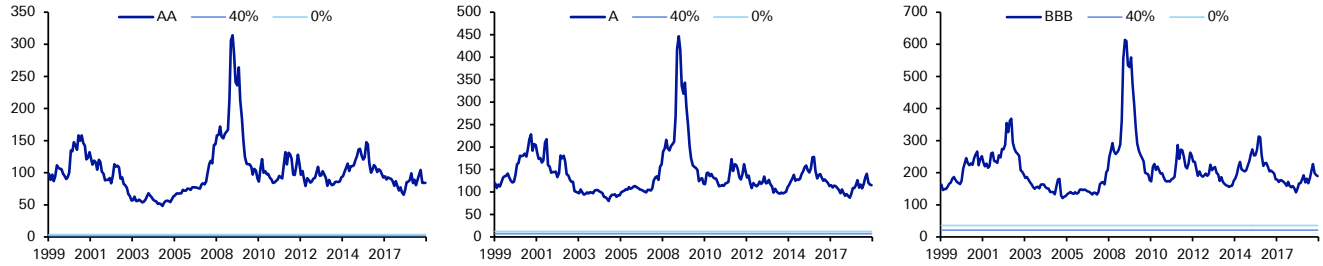
Source: Deutsche Bank, Markit Group

Figure 63: USD AA (left), A (middle) and BBB (right) Index Spread Histories vs. Default-Compensation Spreads (bps)



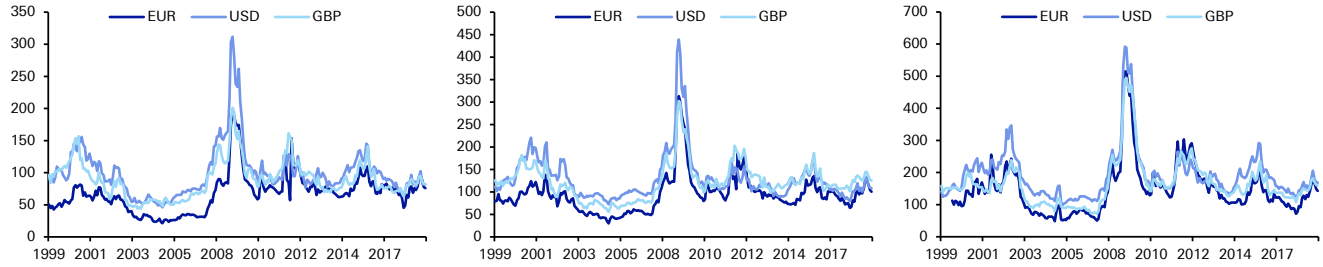
Source: Deutsche Bank, Markit Group

Figure 64: GBP AA (left), A (middle) and BBB (right) Index Spread Histories vs. Default-Compensation Spreads (bps)



Source: Deutsche Bank, Markit Group

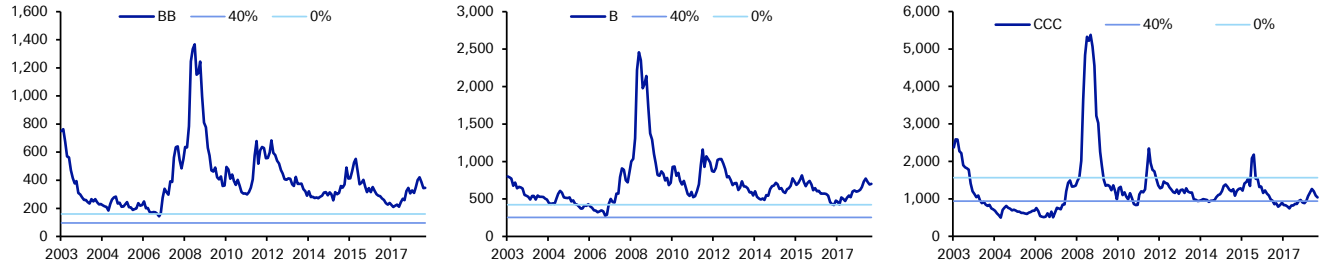
Figure 65: AA (left), A (middle) and BBB (right) Default Spread Premium (bps)



Source: Deutsche Bank, Markit Group

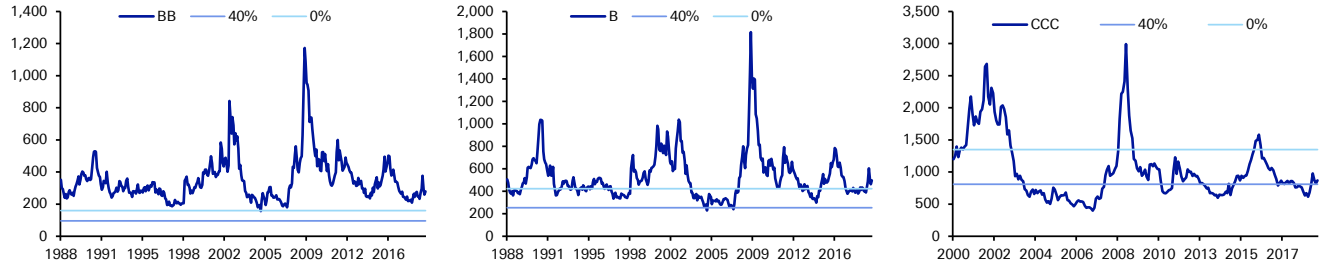
High Yield

Figure 66: EUR BB (left), B (middle) and CCC (right) Index Spread Histories vs. Default-Compensation Spreads (bps)



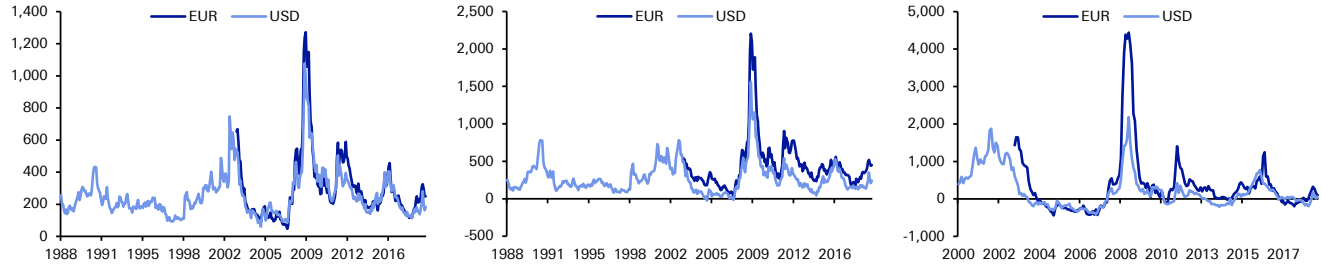
Source: Deutsche Bank, Markit Group

Figure 67: USD BB (left), B (middle) and CCC (right) Index Spread Histories vs. Default-Compensation Spreads (bps)



Source: Deutsche Bank, Markit Group

Figure 68: BB (left), B (middle) and CCC (right) Default Spread Premium (bps)



Source: Deutsche Bank, Markit Group

Why additional spread is required

This piece has only ever aimed to look at the spread required to compensate for default. In effect, it is the first building block in assessing where credit should trade, as defaults are the only way a buy-and-hold investor actually loses money in credit relative to the risk-free investment. In reality, there are other important factors that should be taken into consideration. The unparalleled volatility and stress in credit markets post crisis should be testament to why additional protection may be needed over and above pure default risk. However, trying to put a number to this becomes increasingly subjective and open to interpretation. For those wanting to explore further, these are some of the factors we believe should be considered for those not buying and holding to maturity.

Liquidity

While credit has always tended to be less liquid than government bonds (there were countries where this was not the case post the sovereign crisis), it could be argued this issue remains important largely due to the evolving regulatory environment and significant intervention in recent years. See the earlier section (Liquidity more worrying than defaults) on liquidity risk being a bigger worry to us in the next cycle than default risk for why investors with a mark-to-market requirement may require more compensation.

Return over risk-free alternative

Clearly one does not invest in credit to only get a return equal to the risk-free (i.e., government bonds). We need additional spread for it to be worth holding credit on a risk-reward basis.

What is the risk-free these days?

The sovereign crisis severely compromised the notion of a risk-free rate to benchmark credit. However, in the years since the sovereign crisis we've gone from high sovereign risk and high yields to one where more and more government markets have been trading with negative yields as aggressive central bank intervention dominates. So, investors have had to question the suitability of government credit benchmarks from both extremes over the past few years. This makes it very difficult to assess relative risk.

Cost of credit investing

Clearly, the further you move along the credit curve, the more intensive you need to be in analysing credit. Therefore, the cost base is higher and requires a higher reward than simply that compensating you for default risk. Management fees also have to be paid out of returns.

Ratings transition risk

Some investors can only own bonds down to a certain rating category and may be forced to sell if a bond is downgraded through this lower limit. Hence, we probably need a premium for risk of downward rating migration, especially in troubled times.

Uncertainty and timing of recovery rate

In an event of default the amount and timing of recovery is uncertain.

Short-term performance targets

Investment grade rarely fails to compensate for default risk over the medium to long run, but investors are increasingly measured on a short-term basis. They therefore need some cushion to protect against mark-to-market volatility.

Quantifying these factors is outside the remit of this report. The buy-and-hold investor has lower need to worry about them, though. We hope this report shows the crucial default building block that around which credit spreads are built.

Appendix 1

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David Folkerts-Landau
Group Chief Economist and Global Head of Research

Pam Finelli
Global Chief Operating Officer
Research

Michael Spencer
Head of APAC Research

Steve Pollard
Head of Americas Research
Global Head of Equity Research

Anthony Klarman
Global Head of
Debt Research

Kinner Lakhani
Head of EMEA
Equity Research

Joe Liew
Head of APAC
Equity Research

Jim Reid
Global Head of
Thematic Research

Francis Yared
Global Head of
Rates Research

George Saravelos
Head of FX Research

Peter Hooper
Global Head of
Economic Research

Andreas Neubauer
Head of Germany Research

Spyros Mesomeris
Global Head of Quantitative
and QIS Research

International Production Locations

Deutsche Bank AG
Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

Deutsche Bank AG
Mainzer Landstrasse 11-17
60329 Frankfurt am Main
Germany
Tel: (49) 69 910 00

Deutsche Bank AG
Filiale Hongkong
International Commerce Centre,
1 Austin Road West,Kowloon,
Hong Kong
Tel: (852) 2203 8888

Deutsche Securities Inc.
2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6770

Deutsche Bank AG London
1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

Deutsche Bank Securities Inc.
60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500