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Sector and country diversification in credit portfolios: Downgrade versus market risks

How important are sector and country diversification effects in a credit portfolio? Depending on the metric chosen to represent risk, one can arrive at very different conclusions. From a pure market risk perspective, the scope for sector diversification is limited as spread changes exhibit strong correlations across all market sectors. However, long-horizon portfolio managers are often more sensitive to rating transitions than market spread risk. Historical rates of downgrade show a much greater decoupling between sectors. As a result, the benefits of portfolio diversification are clearer when measured in terms of downgrade risk.

Key findings

- Credit excess returns over treasuries have historically been highly correlated across markets. There is limited potential to diversify *market* risk across countries or sectors.
- Downgrade risk could have been diversified more effectively across sectors than across countries. Downgrade correlations have been low across sectors, but high among major credit markets.
- We analyse the benefits of country and sector diversification in corporate bond portfolios using a risk decomposition that isolates the diversification effect. We find that sector diversification would have reduced downgrade risk, measured as the volatility of realised notch-weighted downgrade rates, by nearly 25% over the past 15 years. The corresponding reduction in excess return volatility is less than 5%.
- From a risk reduction perspective, the primary motivation for diversifying a credit portfolio into foreign markets should be to access industry sectors and issuers not available in the domestic market. Global credit diversification seems therefore more attractive to investors with narrow domestic credit markets.

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Motivation

It is well recognised that reducing diversifiable risk in a portfolio should improve risk-adjusted performance. This would imply that domestic investors might benefit from including foreign issuers in their portfolios. For example, a US investor could buy a euro-denominated corporate bond and hedge out the rates and currency exposures to make it economically equivalent to a US bond. Many portfolio managers do this opportunistically, either to obtain a pricing advantage or to add a favoured out-of-benchmark name to the portfolio. Some investors make a systematic decision to switch from a domestic credit mandate to a global one for precisely these reasons.[1]

However, there are grounds for questioning just how much of a diversification benefit can be obtained from "going global", and whether this benefit is sufficient to justify the effort. Credit markets have exhibited a very strong systematic component. In *Time Dynamics of Credit Active Returns*, we found that even a single-factor model can capture a large part of the variation in credit excess returns, and that the systematic component has been particularly strong over the past few years. Corporate spreads in different sectors and countries have tended to move together, especially in times of crisis.

The evaluation of whether global diversification of credit portfolios is justified will differ for each investor. It will depend on the type of investment portfolio, the governing regulatory framework, the approach to risk measurement, the investment horizon and the breadth of the domestic market.

The breadth of the domestic market largely determines the opportunity set of bonds available to local investors. The US corporate bond market offers a broad diversity of issuers across major corporate sectors, while other markets offer investors a smaller choice of individual names. This might provide an incentive for global diversification. The structure of the global corporate bond market can help evaluate the potential for diversification of issuer-specific risk offered by a global approach.

The next question that investors need to address is critical: to what extent can global diversification reduce risk in the portfolio? Here, the choice of the risk measure considered can have a profound effect on the answers obtained. From a pure market risk perspective, the result will depend in large part on the return correlations between the two market sectors. If a greater focus is placed on downgrade risk, then the result will depend on correlations in downgrade experience. Historical correlations of these two types can lead to very different conclusions as to the effectiveness of diversification.

Both short-horizon and long-horizon investors have reason to focus on downgrade risk. For investors tied to standard market-weighted credit indices, the forced selling of bonds downgraded to below investment grade can pose a significant long-term drag on portfolio performance.

Longer-horizon investors must consider other factors as well. With new regulations and poor secondary market liquidity, more investors are taking a long-horizon approach, in which they are likely to be less affected by transitory spread movements than by rating actions. The effect of downgrades on such investors can be two-fold. There may be an explicit rating-based sell threshold that crystallizes mark-to-market losses upon a downgrade. In addition, the regulation of insurance companies imposes increased capital requirements for lower quality bonds. This increases the cost of holding downgraded bonds for investors who are not forced to sell them.

[1] In ***A Note on Global Treasury Diversification***, we addressed global diversification in government bond portfolios, in which interest rate exposures are diversified from a single domestic government curve to a more varied set of global government rates. We now assume the credit portfolio is managed on an excess return basis, such that FX and interest rates are hedged out regardless. We therefore consider diversification of strictly the credit exposure among different global credit markets.

In a regulatory regime with greater emphasis on ratings transitions, what strategies can we employ to manage this risk? Should we diversify by sector or country? Does sector diversification perform significantly better than country diversification?

We begin by investigating the potential for diversification by extending the investment universe from a given domestic corporate market into a global corporate mandate. For this purpose, we use Barclays index data to profile the global[2] investment-grade corporate bond market by currency of issuance. Next, we evaluate the benefits of country and sector diversification from the perspective of pure mark-to-market spread risk. We then revisit these questions from the viewpoint of downgrade risk, and discuss in greater detail the effect of downgrade risk on long-term portfolio performance. We conclude with a discussion of how these results can be applied to various portfolio situations, considering both systematic and issuer-specific risks.

Structure of the global corporate bond market by currency

In today's "global village", many issuers, especially the larger ones, are multinational corporations that issue in more than one currency. If extending to a global mandate just gives us a chance to buy bonds from the same issuers in additional currencies, it is probably not worth the effort. In Figure 1, we analyse the senior investment-grade corporate bond universe in three currencies (USD, EUR, and GBP). Each issuer in this universe is categorised by the currencies in which they issue. Of the 1,206 issuers covered, only 96 have bonds outstanding in all three of these currencies. However, this relatively small set of large issuers covers 1,811 of the 5,643 bonds in this universe, or 45% of the overall market value.

The large number of issuers that issue only in USD means that the amount of portfolio diversification available to domestic investors in the US is much greater than for UK or European investors.

The UK domestic corporate market also tends to be characterised by longer maturities, higher spreads, and higher liquidity cost scores[3] than either the US or European corporate bond markets. A recently published analysis, *Corporate Liquidity across Markets*, showed that the apparent differences in liquidity across these markets can be largely attributed to the structural differences among them.

FIGURE 1

Profile of the global corporate market by currency of issuance: senior, non-callable IG corporate bonds in USD, EUR, or GBP from the Barclays Global Aggregate Index (as of 28 November 2014)

	Universe	GBP	EUR	USD	GBP-only	EUR-only	USD-only	GBP-EUR	GBP-USD	USD-EUR	GBP-USD-EUR
Number of Bonds	5,643	555	1,260	3,828	171	410	2,424	163	144	520	1,811
Number of Issuers	1,206	222	344	940	80	156	766	30	16	62	96
MV (GBP bn)	3,410	272	949	2,190	62	229	1,051	90	91	347	1,540
Avg L-OASD (yr)	5.95	8.61	4.69	6.17	9.87	4.40	6.32	6.25	7.88	5.35	5.78
Avg L-OAS (bp)	93	119	44	111	133	57	129	77	114	72	76
Avg Liquidity Cost Score	0.70	0.92	0.37	0.83	1.38	0.47	1.03	0.63	0.95	0.56	0.53
Avg MV per issuer (GBP bn)	2.8	1.2	2.8	2.3	0.8	1.5	1.4	3.0	5.7	5.6	16.0
% of global MV		8%	28%	64%	2%	7%	31%	3%	3%	10%	45%

Source: Barclays Research

[2] We consider the USD, EUR and GBP which constitute more than 93% of the market value of the Barclays Global Aggregate Corporate index, to be representative of global IG corporate issuers. Japan has a much smaller and more concentrated corporate market, constituting less than 2.5% of the index, roughly a third the size of the GBP component.

[3] Liquidity cost scores (LCS), calculated by Barclays at the security level, represent the estimated cost of a round-turn transaction in a particular bond. For more details, see ***Introducing LCS – Liquidity Cost Scores for US Credit Bonds***.

Figure 2 provides industry profiles of the different currency markets. We see that the motivation for global diversification depends on the base currency. In certain sectors (notably Technology), a diversified representation is available only in the US market. UK investors who restrict themselves to their domestic credit market will not get significant exposure to some industries, such as Technology, Brokerage, and Capital Goods. Domestic European credit investors are somewhat better off, but will still gain significant opportunities for issuer diversification by extending to a global credit mandate. For US investors, the benefits of global diversification are less apparent, but there are still some sectors in which a global mandate would broaden the available pool of issuers substantially, such as Natural Gas and Other Utilities.

FIGURE 2

Industry profile by currency of issuance: senior, non-callable IG corporate bonds in USD, EUR, or GBP from the Barclays Global Aggregate Index (as of 28 November 2014)

Number of issuers by sector (Class 3)	Universe	GBP	EUR	USD	GBP-only	EUR-only	USD-only	GBP-EUR	GBP-USD	USD-EUR	GBP-USD-EUR
BANKING	173	32	74	138	2	32	96	1	1	13	28
BASIC_INDUSTRY	79	7	20	68	0	9	59	2	0	4	5
BROKERAGE_ASSETMGRS_EXCHANGES	35	4	6	31	1	1	28	2	0	2	1
CAPITAL_GOODS	71	6	25	57	0	11	45	3	1	9	2
COMMUNICATIONS	65	23	31	51	2	8	29	4	3	5	14
CONSUMER_CYCLICAL	86	18	30	62	5	16	50	3	1	2	9
CONSUMER_NON_CYCLICAL	147	23	45	129	3	13	96	2	3	15	15
ELECTRIC	68	11	15	56	2	7	49	3	2	1	4
ENERGY	90	7	11	85	0	5	77	0	2	1	5
FINANCE_COMPANIES	13	3	5	9	1	3	7	0	0	0	2
FINANCIAL_OTHER	46	28	2	17	28	1	16	0	0	1	0
INDUSTRIAL_OTHER	40	5	6	33	2	3	32	2	0	0	1
INSURANCE	85	8	13	73	4	7	68	1	0	2	3
NATURAL_GAS	30	8	12	14	6	10	12	0	0	0	2
REITS	54	8	16	34	6	13	31	1	1	2	0
TECHNOLOGY	56	1	7	53	0	3	49	0	0	3	1
TRANSPORTATION	52	17	19	26	11	13	20	2	2	2	2
UTILITY_OTHER	16	13	7	4	7	1	2	4	0	0	2
Sum	1206	222	344	940	80	156	766	30	16	62	96

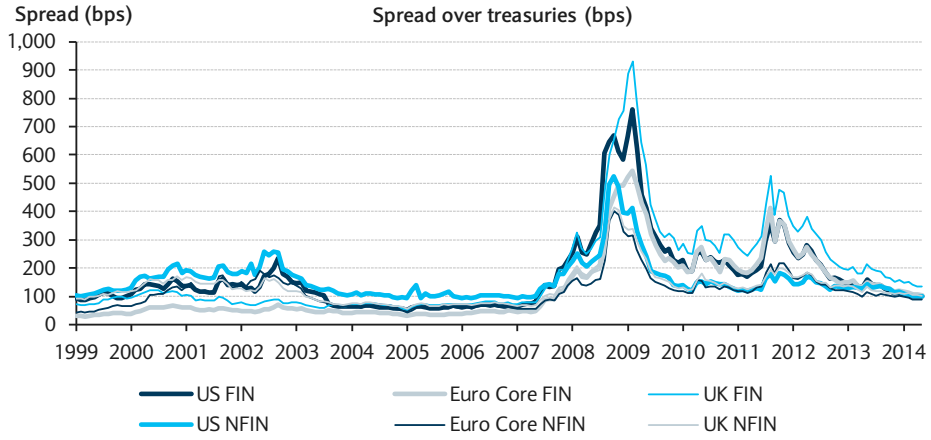
Source: Barclays Research

Can mark-to-market risk be diversified?

In the financial crisis of 2008-09 and the sovereign crisis of 2010-11, spreads increased across all countries and sectors. In *Time Dynamics of Credit Active Returns*, we have shown that much of the variation in spreads and excess returns can be explained by a single market-wide factor. Some benefits can be observed by coarse partitioning into Financials, Utilities and Industrials, but the additional explanatory power from finer partitioning is small. Figure 3 confirms those earlier results by showing that the spread dynamics of different countries and sectors are quite similar.

FIGURE 3

Country-sector spreads over treasuries for selected sub-groups of Barclays Global Aggregate Corporate Index: February 1999– June 2014



Note: Financial and Non-Financial Issuers are grouped by country rather than currency. Spreads are first computed relative to the Treasury curve in each currency of issuance (USD, EUR, GBP) and then averaged using market weights.
Source: Barclays Research

In Figure 3, corporate asset classes are defined by industrial sector (financial or non-financial) and country of domicile[4]. We show average spreads for issuers domiciled in the US, the UK, and eurozone core countries. The index of US issuers, for example, would include those issuing in USD, EUR and GBP weighted by their market capitalisation. To avoid the effects of sovereign spreads on corporate issuers[5], peripheral eurozone markets are excluded. Issuers are split into two broad sectors, Financials and Non-financials. Spreads have been linked closely across regions and sectors since 1999, as is evident in Figure 3. Indeed, there appears to be a sector effect, with financials showing a larger spike in spreads in the sovereign crisis of 2010-11. However, non-financials were not totally immune to this event, showing spread increases of a smaller magnitude.

To confirm the intuition of closely linked spread movements, we analyse the correlations of yearly excess returns[6] across countries and sectors (Figure 4). We observe that excess returns are highly correlated across sectors and countries. The former seems to be the dominant dimension: correlations among bonds within a given sector from different countries are all 90% or higher. However, all of these asset classes are highly correlated with each other. Even the cross-sector correlations are substantial, with none lower than 67%.

[4] Most benchmark bond indices, such as the Barclays US Aggregate index, are specific to a currency. However, partitioning by country of domicile rather than currency allows us to obtain market-based results that are more directly comparable to the transition-based analysis in the latter part of this article.
[5] During the euro sovereign crisis, spreads widened throughout the eurozone, particularly in financials. However, corporate issuers based in peripheral countries experienced additional spread widening based on the risk of their home country. For a detailed analysis, see ***Sovereign Risk Spill-over into Euro Corporate Spreads***.
[6] Excess return is defined as the return of a corporate bond relative to a duration-matched Treasury portfolio in the same currency. We first calculate rolling 12-month cumulative excess returns for each asset class, and then compute correlations among these to enable meaningful comparisons with downgrades. Use of overlapping 12-month observations reduces the effective number of independent observations and, thus, the accuracy to which we can estimate the correlations and statistics in Figures 4 and 5. We do this to align the horizon of this excess return analysis with that of the downgrade analysis in the next section.

FIGURE 4

12-month rolling excess return correlations: February 2000 – June 2014

	US FIN	EU CORE FIN	UK FIN	US NON - FIN	EU CORE NON - FIN	UK NON - FIN
US FIN	100%	95%	90%	89%	90%	94%
EU CORE FIN	95%	100%	97%	76%	81%	86%
UK FIN	90%	97%	100%	67%	70%	78%
US NON - FIN	89%	76%	67%	100%	98%	95%
EU NON - FIN	90%	81%	70%	98%	100%	97%
UK NON - FIN	94%	86%	78%	95%	97%	100%

Note: Monthly index excess returns are first cumulated over a rolling 12-month window for each asset class, and monthly correlations of these overlapping 12-month returns are then calculated over the entire period.
Source: Barclays Research

Figure 5 reports additional statistics for the credit asset classes shown in Figure 4. From the same time series of rolling 12-month cumulative excess returns, we now compute the average annual excess returns, as well as volatilities and tail risk measures such as Conditional Value at Risk (CVAR). The CVAR is defined relative to a confidence level. The 75% CVAR shown in Figure 6 is the average return in the lowest quartile of annual excess returns for a given portfolio; the 90% CVAR gives the average over the lowest decile. We observe that Financials are significantly more volatile than Non-financials in all three country markets examined, and exhibit greater tail losses as well.

FIGURE 5

Statistics of excess returns over annual horizons (%/y) for G3 financial and non-financial corporate from Barclays Global Aggregate Index, February 1999 – June 2014

	US FIN	EURO CORE FIN	UK FIN	US NON-FIN	EURO CORE NON-FIN	UK NON-FIN
Average	1.1	0.7	0.5	0.6	0.9	1.1
Volatility	7.9	5.2	10.1	5.8	3.5	4.3
CVAR (75%)	-7.6	-5.3	-10.8	-5.6	-2.9	-3.6
CVAR (90%)	-14.3	-9.5	-20.2	-8.7	-4.6	-6.6

Note: We use cumulative excess returns over a rolling 12-month window. Source: Barclays Research

We illustrate the benefits of diversification with a simple exercise of allocating across US, Euro-Core and UK markets. Figure 6 compares a 100% market value allocation to US Financials with portfolios that allocate 50% away from US financials and into other country-sector indices. For example, the second column of results is for a portfolio of 50% US Financials and 50% Euro Core Financials.

When we replace part of the allocation to US Financials with allocations to other buckets, the resulting change in volatility is due to two effects. First, the diversifying asset class has a different volatility; as shown in Figure 5, all of the Non-financial asset classes had lower excess return volatilities than US Financials over the study period. Any allocation to non-financials thus reduces the excess return volatility of this portfolio. The second effect is from

diversification due to imperfect correlations across buckets. Diversification implies that the portfolio volatility should always be lower than a simple weighted average of the individual asset class volatilities.

To focus on this second effect, we define a measure called the "diversification effect",[7] which measures the proportional change in volatility of a portfolio relative to the weighted average volatility of its components. The weighted average volatility is the portfolio volatility if assets were correlated perfectly. Therefore, the diversification effect of a portfolio indicates the reduction in risk from imperfect correlations. We can use the same technique to highlight the role of diversification in reducing tail risk as well, looking at the reduction in CVAR relative to a weighted average CVAR[8].

Figure 6 indicates that the diversification effect of mark-to-market spread risk is limited across sectors and countries. The second column indicates that the annual excess return volatility of a 50/50 combination of US and Euro Core financials is about 6.5%, 18% lower than the 7.9% for US financials alone. However, the reduction in volatility is driven largely by the lower volatility of Euro Core financials. The volatility reduction from imperfect correlations is only 1.5%. The diversification potential is similarly low in the tails. For example, the 50/50 blend of US and UK financials has a 90% CVAR of -17.0%. The magnitude of this loss is reduced by 1.5% from the -17.25% that would be obtained by averaging the 90% CVARs shown for these two asset classes in Figure 5.

FIGURE 6

Risk and diversification of excess returns over annual horizons, February 1999 – June 2014

	US FIN	US FIN & EU CORE FIN	US FIN & UK FIN	US FIN & US NON-FIN	US FIN & EU CORE NON-FIN	US FIN & UK NON-FIN
Average (%/y)	1.1	0.9	0.8	0.8	1.0	1.1
Volatility (%/y)	7.9	6.5	8.8	6.7	5.5	6.0
CVAR (75%) (%/y)	-7.6	-6.4	-9.1	-6.3	-5.0	-5.5
CVAR (90%) (%/y)	-14.3	-11.7	-17.0	-11.1	-9.3	-10.4
Diversification effect: Volatility		-1.5%	-2.4%	-2.9%	-2.2%	-1.4%
Diversification effect: CVAR (75%)		-0.8%	-0.7%	-4.5%	-4.0%	-1.6%
Diversification effect: CVAR (90%)		-1.7%	-1.5%	-3.0%	-1.3%	-0.7%

Note: Excess returns are calculated monthly, then aggregated over overlapping 12-month windows. Statistics are computed over monthly time series of these overlapping 12-month excess returns. Results are shown for a 100% allocation to US Financials, and for 50/50 blends of this asset class with one other. Source: Barclays Research

Diversifying into non-financials also appears to have limited benefits. The effect of imperfect correlations reduces excess return volatility by only 2-3%. While the diversification effect provides a slightly larger reduction in risk as measured by 75% CVAR (the average excess return over the worst 25% of monthly results), the benefits remain negligible even further out along the tail of the distribution. The bottom row of Figure 6 shows that in the worst 10% of monthly excess returns, the biggest loss reduction achieved was just 3%.

[7] Choueifaty and Coignard (2008) use a similar measure that takes the ratio of the weighted average volatility to portfolio volatility. We use the inverse of their measure minus 1 to indicate the proportional change in volatility from imperfect correlations.

[8] Risk measures such as volatility and CVAR have the useful property of sub-additivity: due to the nature of the calculation, the portfolio risk is guaranteed to never be larger than the weighted average risk of its components. The diversification effect will therefore be zero or negative. Note that VAR does not have this property; were we to try to apply it to VAR, the diversification effect might turn out to be positive.

Diversifying downgrade risk

Diversifying by sector appears to have limited benefits in terms of reducing market spread risk. However, for many credit investors with longer investment horizons, the greatest risk to the portfolio could take the form of a wave of credit downgrades. In this section, we test the efficacy of country/sector diversification in terms of downgrade risk.

For our analysis, we seek a measure of downgrade experience that will capture both the frequency and severity of downgrades. We have chosen to use "downgrade notch rates", which we calculate using Moody's data. For different country/industry datasets, Moody's reports the frequency and magnitude of rating transitions using a set of alphanumeric ratings for a selected cohort start date and horizon. We set up monthly cohorts and track them over a 12-month horizon. We then aggregate the total number of downgrade events from investment-grade issuers, multiply it by the number of notches of each downgrade (for example, a downgrade from A3 to Baa2 is a two-notch downgrade), and normalise it by the average number of issuers in the cohort over the period. The resulting "downgrade notch rate" is essentially the product of the realized downgrade rate times the average number of notches per downgrade.[9]

Figure 7 summarises the statistics of these downgrade notch rates for financial and non-financial issuers from the US, UK, and core eurozone. For each of these sectors, we report the average annual downgrade notch rate and the volatility of this rate. In addition, to measure tail risk, we report CVAR[10] at the 75% and 90% levels, which are the average downgrade notch rates during the worst 25% and worst 10% of observed 12-month periods. We see that while the average downgrade rates are just slightly higher for financials than for non-financials, the risk measures show much greater variation in financials. In fact, in the worst 10% of outcomes for EU and UK financials, we observe downgrade notch rates above 100%![11]

[9] In this work, we essentially use the number of notches to approximate the severity of a downgrade. In other studies, such as *Sufficient Diversification in Credit Portfolios*, we have estimated downgrade losses empirically based on realised excess returns of downgraded bonds.

[10] Technically, the tail statistics used in our analysis of downgrade risk should not be referred to as CVAR, since they are not in units of "value" at risk. As stated above, we use this term to describe the average downgrade notch rates in the tail of the distribution beyond a certain confidence level. We will not compare these numbers directly to the CVAR numbers from the excess return distribution; we just measure the relative changes in the different risk measures that result from sector/country diversification.

[11] Note that although it is impossible for more than 100% of the issuers to be downgraded in a given year, our notch-weighted calculation allows for downgrade notch rates above 100%. In fact, the highest downgrade notch rate for any 12-month cohort was observed in the cohort of UK financials formed at the start of June 2008. In that case, 51% of the issuers in the cohort were downgraded an average of 2.9 notches over the following year, for a downgrade notch rate of 147%. Note that this includes some issuers jumping directly from ratings of A1 or A2 all the way to default.

FIGURE 7

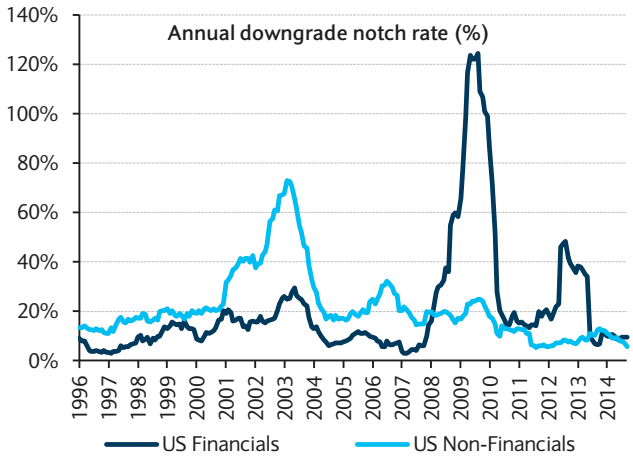
Downgrade notch rate statistics (% of issuers, y/y): January 1999 – June 2014

	US FIN	EU CORE FIN	UK FIN	US NONFIN	EU CORE NONFIN	UK NONFIN
Average	24%	29%	34%	23%	23%	26%
Volatility	26%	31%	33%	16%	14%	17%
CVAR (75%)	58%	75%	80%	46%	43%	52%
CVAR (90%)	92%	101%	113%	60%	52%	63%

Source: Moody's, Barclays Research

FIGURE 8

Downgrade notch rate for US issuers: January 1999 – June 2014



Source: Moody's, Barclays Research

Figure 8 shows the time series of 12-month trailing downgrade notch rates for the US financial and non-financial sectors. The dynamics of downgrade rates for the two sectors are quite different. It essentially tells the story of two crises: the dot-com crisis of 2001-03, which caused a wave of downgrades among non-financial issuers; and the global financial crisis of 2008, which caused an even larger downgrade cycle for financials. This view of the two sectors' performance stands in stark contrast to Figure 3, where spreads appear to move in lockstep regardless of country or sector. Viewed in terms of downgrade risk, the importance of sector diversification is clearer.

In Figures 9 and 10, we see that downgrades are strongly correlated within a given sector across countries of domicile. Figure 9 shows the correlation matrix of rolling 12-month downgrade notch rates for issuers from the six country/sector cells considered. Contagion appears to be driven by sector effects, with little differences across countries of domicile. Correlations in the top-left quadrant – among the financial sectors of the three geographies – are all strongly positive, as are those among non-financials in the bottom-right quadrant. However, correlations between financial and non-financial sectors – shown in the off-diagonal quadrants – are near zero. These results contrast our earlier findings regarding high correlations of excess returns across both sectors and countries in Figure 4.

Figure 10 confirms the same result visually, using the time series of rolling 12-month downgrade notch rates from our six country/sector cells. The top chart shows the downgrade experience of financial issuers from the three country groups. The country downgrade rates of financial firms are seen to follow a very similar pattern – but very different from the pattern for their non-financial peers in the bottom chart.

FIGURE 9

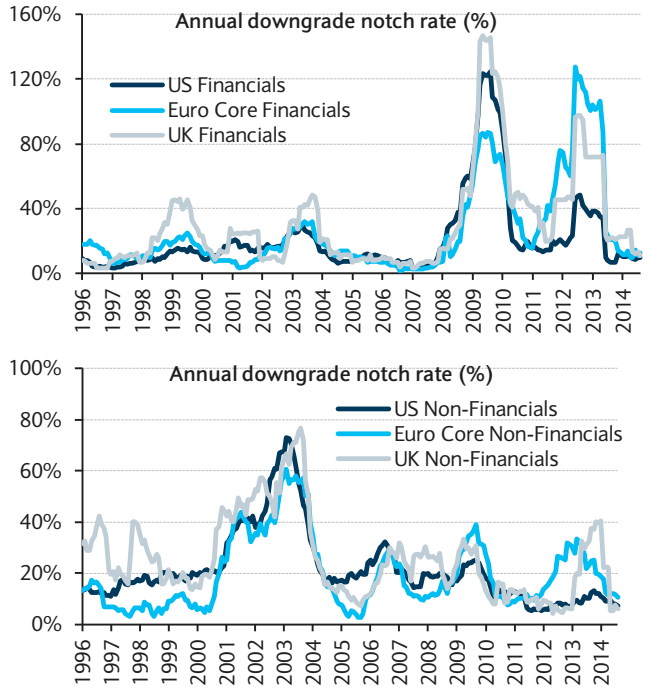
Downgrade notch rate correlations, January 1999 – June 2014

	US FIN	EU CORE FIN	UK FIN	US NONFIN	EU CORE NONFIN	UK NONFIN
US FIN	100%	67%	91%	-4%	26%	-2%
EU CORE FIN	67%	100%	84%	-32%	17%	-27%
UK FIN	91%	84%	100%	-17%	25%	-12%
US NON-FIN	-4%	-32%	-17%	100%	78%	86%
EU CORE NON-FIN	26%	17%	25%	78%	100%	82%
UK NON-FIN	-2%	-27%	-12%	86%	82%	100%

Source: Moody's, Barclays Research

FIGURE 10

Downgrade notch rates for US, UK, and Euro core issuers, from Financial and Non-Financial sectors, January 1999 – June 2014



Source: Moody's, Barclays Research

We now try to quantify the benefits of diversification by country and sector in terms of downgrade risk, following a similar approach to our analysis of excess returns. We start with a portfolio fully invested in US financials and measure the diversification of downgrade risk that can be obtained by shifting 50% of this portfolio to each of the other sectors in turn. For example, the second portfolio considered is an even blend of US financials and Euro financials. As in the analysis of excess return diversification in Figure 6, we calculate the "diversification effect" showing the extent to which sector diversification is responsible for the changes in our various measures of downgrade risk. To calculate downgrade risk, we represent each sector by the sequence of 12-month downgrade notch rates that we calculated from Moody's transition data. The results are shown in Figure 11.

If we focus on the blend of US and UK financials, we find a very mild diversification benefit. The diversification effect reduces the volatility of the downgrade notch rate in the portfolio by less than 2% relative to the average volatility of the two asset classes; the result is similar for the tail risk statistics. However, if we diversify into non-financials from any geography, we see a much more striking change. For the blend of US financials and US non-financials, for example, the diversification effect reduces the volatility of downgrade risk by 27.6% and the 90% CVaR by 22.0%. Sector diversification between financials and non-financials provides a significant reduction in portfolio downgrade risk.

FIGURE 11

Diversification of downgrade risk by country and sector: statistics of annual downgrade notch rates for various portfolios, January 1999 – June 2014

	US FIN	US FIN & EU CORE FIN	US FIN & UK FIN	US FIN & US NON-FIN	US FIN & EU CORE NON-FIN	US FIN & UK NON-FIN
Average	24%	27%	29%	24%	24%	25%
Volatility	26%	26%	29%	15%	17%	16%
CVAR (75%)	58%	66%	68%	45%	46%	47%
CVAR (90%)	92%	89%	101%	59%	61%	61%
Diversification effect: Volatility		-8.5%	-2.1%	-27.6%	-18.5%	-28.5%
Diversification effect: CVAR (75%)		-2.0%	-2.2%	-13.1%	-8.3%	-14.8%
Diversification effect: CVAR (90%)		-8.2%	-1.7%	-22.0%	-15.5%	-21.5%

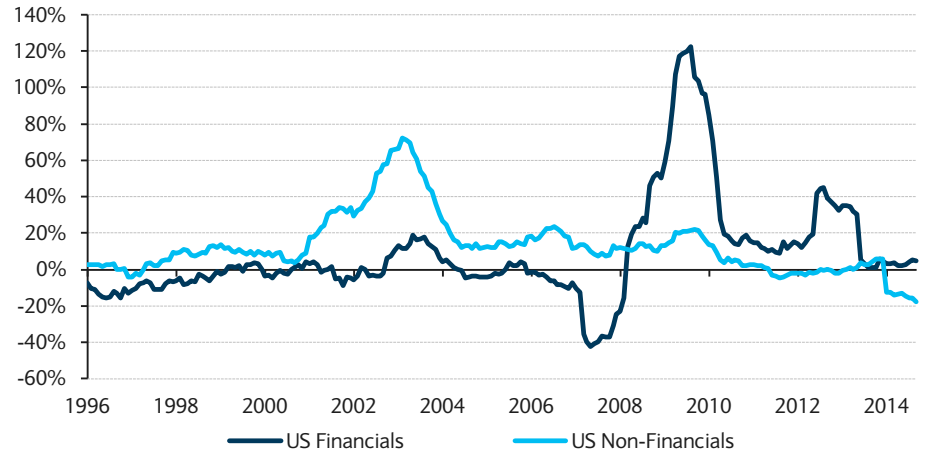
Note: Portfolio of 100% US Financials is compared with 50/50 blends of US Financials and each other sector.
Source: Moody's, Barclays Research

The effect of ratings drift on credit portfolio performance – why downgrades matter

The analysis of ratings transitions in the previous section was purely one-sided. While Moody's data contain a record of upgrade and downgrade events, we selectively reported only the downgrades. We have used the same approach to calculate upgrade notch rates as well, which are typically lower than the downgrade rates. In Figure 12, we subtract the upgrade notch rates from the downgrade notch rates to obtain "net downgrade notch rates", which are positive when downgrades dominate and negative when upgrades form the majority of transitions.

FIGURE 12

Net downgrade notch rate for US issuers: January 1999 – June 2014



Source: Moody's, Barclays Research

We include Figure 12 here for two reasons: first, it highlights the difference in behaviour between financials and non-financials perhaps even better than Figure 8; and second, it highlights the fact that credit markets have tended to see more downgrades than upgrades. This creates a situation in which fixed cohorts of corporate bonds tend to experience negative ratings drift over their lifetime. This affects all credit portfolios, although it can manifest itself in very different ways.

Standard market-weighted indices of investment-grade credit do not exhibit a steady rating drift in ratings. Standard indices immediately drop bonds following a downgrade to below investment

grade. Furthermore, the index is refreshed continuously, with new issues taking the place of those that exit. However, while these mechanisms help the index maintain a fairly stable credit rating, the forced selling of "fallen angel"[12] bonds at what is perhaps the worst possible time tends to generate large losses. We have found that this effect significantly dilutes the long-term excess returns of IG bonds, especially Baa rated. Based on these findings, we recommend that portfolio managers and plan sponsors avoid strict rules that force the immediate sale of fallen angel bonds. We have suggested the adoption of downgrade-tolerant benchmarks[13] and/or the extension of the window for selling fallen angels to 12-24 months. For this study, the key observation is that even in fully mark-to-market credit portfolios, a key to long-term performance is the sell discipline used to deal with adverse credit stories. For many investors, rating agency action can play a part in this process.

For longer-horizon investors, there are additional reasons to focus on downgrade risk. A simplistic view divides investors into "mark-to-market" or "buy-and-hold" categories, with the former focused on monthly mark-to-market risk and the latter working strictly in a book accounting framework. However, many credit investors today fall between these two extremes. Bonds may be purchased with the intent to hold to maturity, but downgrades can trigger sales of affected assets. We have introduced a framework for *"Try and Hold" Credit Investing*, which allows asset class risk and return to be evaluated subject to a given discipline for forced sales. A policy of forced selling at any downgrade to below investment grade is found to underperform less aggressive policies such as selling only upon a downgrade to B (or lower). Some asset managers advocate an approach they refer to as "buy and maintain", in which manager discretion about whether and when to liquidate degraded issues is seen as the key to good risk-adjusted performance.

A buy-and-hold or buy-and-maintain portfolio is less likely to suffer from an inflexible forced selling policy, yet we would expect credit quality to trend downward due to ratings drift. In certain regulatory capital frameworks, this could carry with it an expectation that capital charges will increase over time. In fact, such a regulatory framework can make it critical to manage downgrade risk. For example, Solvency II insurance regulation[14] allows for a matching adjustment for spread movements in buy-and-hold portfolios. This means that the ALM position is largely unaffected by spread movements that are not accompanied by rating action. As a result, downgrades can harm portfolio performance in two ways. First, the full extent of spread expansion is not matched if there is a rating action[15]. Second, capital charges increase as issuers are downgraded.

As discussed, a certain amount of downward ratings drift is expected. However, the primary risk for a buy-and-hold portfolio is not that of a slow and steady ratings drift, but rather of a wave of downgrades that strikes the portfolio at once. Therefore, the risk we have focused on is the variation in the downgrade rates.

Allocations to finer sectors and idiosyncratic risk

Our analysis of diversification by country and sector has been based so far on a very crude two-sector partition of the corporate bond universe into financials and non-financials. We were not able to use a finer sector partition due to insufficient data in smaller markets such as the UK. From this exercise, we broadly concluded that diversification between these two

[12] Fallen angels significantly underperform their investment grade peers and subsequently outperform their high yield peers after the downgrade. See ***Fallen Angels – Characteristics, Performance and Implications for Investors***.
[13] For an analysis of the effect of downgrade losses on long-term returns of credit indices, and a proposal of alternative benchmarks that continue to hold downgraded bonds, see ***Capturing Credit Spread Premium***.
[14] **"Consultation Paper on the proposal for Implementing Technical Standards on the procedures to be followed for the approval of a matching adjustment"**, EIOPA, 1 April 2014.
[15] Under Solvency II, insurers can offset changes in bond spread less fundamental spread with a matching adjustment. The fundamental spread, which is a proxy for long-term default probability, is a function of rating and maturity of a bond. Increases in spread without a corresponding rating action can be offset when reporting ALM positions.

coarse sectors provides a significant reduction in downgrade risk, and that systematic downgrade trends seem to have been largely determined by sector rather than country allocation. Thus, from both the market risk and downgrade risk perspectives, recent data show no great need for geographical diversification among the three major credit markets as long as sufficient sector and issuer diversification can be achieved. However, as shown in Figure 2, the UK and European markets do not offer the same depth as the US market in a number of industries. The Technology industry, for example, is well represented only in the US market. Industry-specific events can potentially cause a wave of downgrade risk confined to a particular industrial sub-sector, such as tobacco or energy. Investors concerned that downgrade risk may decouple by industry in this way will want to ensure diversification among finer industry groups and this could require geographical diversification.

To probe into the usefulness of finer industry diversification, we examine the downgrade data after combining issuers from all three geographical regions. Summary statistics for downgrade notch rates for different sectors are shown in Figure 13. We find that "non-financials" is far from being a homogenous sector: different industries within this category have had very different downgrade experiences. For example, downgrade notch rates within Retail have been more than double those in the Transportation sector.

FIGURE 13

Downgrade notch rate statistics for combined universe of issuers (February 1999 - June 2014)

Sector	Number of issuers	Average	Volatility	CVAR 75%	CVAR 90%
Financials	649	27%	28%	68%	95%
Non Financials	1,092	24%	16%	47%	60%
Cap Industries	225	28%	19%	57%	66%
Cons Industries	174	20%	10%	34%	37%
Energy	130	20%	27%	55%	88%
Media	50	25%	26%	64%	86%
Retail	48	35%	22%	61%	67%
Technology	146	32%	22%	61%	84%
Transportation	43	16%	13%	34%	49%
Utilities	276	19%	19%	45%	67%

Source: Moody's, Barclays Research

In terms of diversification, the correlations among downgrade rates in different industries are perhaps more important than the overall rates. Figure 14 shows downgrade correlations for finer sub-sectors after pooling the data across all three geographic regions. Financials appear to be de-correlated from most non-financial sectors, confirming the importance of the top-level allocation between financials and non-financials. While correlations are generally positive within non-financials, they are far from perfect. Indeed, there are diversification benefits to be had by distributing the portfolio across finer sectors within non-financials.

FIGURE 14

Downgrade notch rate correlations: January 1999 – June 2014

	Financials	Non Financials	Cap Industries	Cons Industries	Energy	Media	Retail	Technology	Transportation	Utilities
Financials	100%	-12%	17%	-22%	-10%	-13%	-20%	-25%	6%	-13%
Non Financials	-12%	100%	81%	68%	79%	57%	63%	87%	49%	92%
Cap Industries	17%	81%	100%	68%	41%	42%	64%	55%	62%	60%
Cons Industries	-22%	68%	68%	100%	23%	47%	66%	51%	63%	50%
Energy	-10%	79%	41%	23%	100%	32%	15%	73%	15%	85%
Media	-13%	57%	42%	47%	32%	100%	51%	50%	45%	39%
Retail	-20%	63%	64%	66%	15%	51%	100%	51%	40%	44%
Technology	-25%	87%	55%	51%	73%	50%	51%	100%	27%	81%
Transportation	6%	49%	62%	63%	15%	45%	40%	27%	100%	28%
Utilities	-13%	92%	60%	50%	85%	39%	44%	81%	28%	100%

Source: Moody's, Barclays Research

One final item to consider is idiosyncratic risk. It is well understood that a large concentration in any single issuer can expose the portfolio to the risk of a credit event for that issuer. To keep this risk at an acceptable level, it is important to diversify the issuer composition of the portfolio. Yet within a given universe of credits, it is likely that just a small fraction of the available issuers have been flagged as most favoured by a team of credit analysts. A manager often faces a challenging trade-off between buying a concentrated portfolio of favoured issuers or a more diversified portfolio that includes less favoured names or those that have not been researched at all.[16]

This problem is exacerbated by a universe that has a limited number of names to begin with. One way around this dilemma is to extend the universe of available names into other geographical regions (though this requires extending research coverage into these regions as well, which could entail additional management costs). Global diversification could thus be viewed as a mechanism for allowing the manager to achieve the desired sector diversification without being forced to choose between large portfolio concentrations or compromising on name selection.

Conclusion

The benefits of sector diversification, although limited from the perspective of mark-to-market risk, can be substantial in terms of downgrade risk. Historical simulations of portfolios that diversify across major sectors show a near-25% reduction in downgrade volatility and tail risk. If we set aside sector and issuer exposures, diversification by geographic region does not seem to have a material effect on portfolio performance over the time period studied.

However, global diversification can give managers greater flexibility in achieving the desired level of diversification over corporate industries and issuers. Historical data on downgrades emphasise the critical importance of maintaining a proper balance between

[16] In *Sufficient Diversification in Credit Portfolios*, we combined a model of portfolio downgrade risk with assumptions about analyst skill to explore the trade-off between diversification and return maximization.

exposures to the financial and non-financial sectors. When the data are sliced into finer sectors, it is harder to achieve statistically significant results, but there are indications that diversification by industry group should be helpful. For home markets with a diversity of well-populated sectors, one may not have to consider foreign markets to diversify downgrade risk. However, for home markets with substantial sector biases, a reasonable strategy would be to invest in complementary sectors within foreign markets. The final consideration would be issuer diversification. Here again, investors in Europe and the UK may find greater incentive than US investors to look abroad. Opening the portfolio to other geographies can help managers achieve the desired issuer diversification without being forced to compromise on name selection.

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