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Reduce the Volatility of your Pension Plan's Funding Ratio by Using Quantitative Probability of Default Measures

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Summary

Moody's Analytics EDF™ (Expected Default Frequency) probability of default measures can help pension plan sponsors and their advisors to reduce the volatility of the plans' funding ratios as they are reported on corporate financial statements. Moreover, EDFs identify corporate bonds with particularly stable credit characteristics, but which still provide good levels of yields and returns. The key to this success is that the corporate bond markets, both investment grade and high yield, appear not to accurately price in default risk. Investment managers who use EDFs in their bond selection and portfolio maintenance routines can thus gain a critical advantage.

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When de-risking fails

The goal of a liability-driven investment strategy is to "de-risk" a company's pension exposure by matching the value of its pension assets and liabilities under a range of market and actuarial assumptions. Corporate bonds[1] feature prominently in LDI programs for two reasons: 1) typically, the average yield on a portfolio of highly rated corporate issues (such as the Citi Pension Liability Index) provides the discount rate to determine the present value of a company's pension liability; and 2) the securities' cash flow characteristics are similar those of the pension liabilities. But as we explain in the next section, the credit risk inherent in corporate securities means that such "de-risking" strategies often fall short of their goals. EDF metrics from Moody's Analytics (which we describe later in this paper) can help mitigate these problems by providing insight into corporate bond credit risk, in particular in relation to expected yields and returns.

Nothing ruins a good LDI strategy like downgrades and defaults

US pension accounting standards and funding requirements mean that the volatility of defined benefit pension fund liabilities and assets impact directly on companies' published financial statements. Hence the popularity of liability-driven investment strategies, which aim to minimize or eliminate this undesirable effect. While investments in long duration, highly rated corporate bonds form a key component of a successful LDI strategy, the efficacy of this approach is reduced by a significant shortcoming. That is, there is no credit risk in the actuarial assumptions, such as assumed retirement ages and employee lifespans, that underpin the level of a firm's pension liability. But the prices of the corporate bonds, which are supposed to offset the liability, reflect such risk. Thus, a bond portfolio's value will change if the issues' ratings are lowered or if they default.[2] In this way corporate securities' credit risk creates a mismatch between the behavior of pension fund assets and pension liabilities. If the rates of downgrades and defaults are significant, plan sponsors and fund managers will find that the "de-risking" benefits of their LDI strategies will be less than anticipated.

Downgrades impinge upon a firm's LDI strategy on the liability side of the balance sheet as well. Usually, the index that determines the discount rate for the pension liabilities is the one used to guide the construction of its corporate bond portfolio. If a downgraded bond's rating has fallen below the index's minimum level, it will leave the benchmark. Since such bonds carry relatively high yields, the index's average yield would fall as a result, increasing the present value of the pension liability.

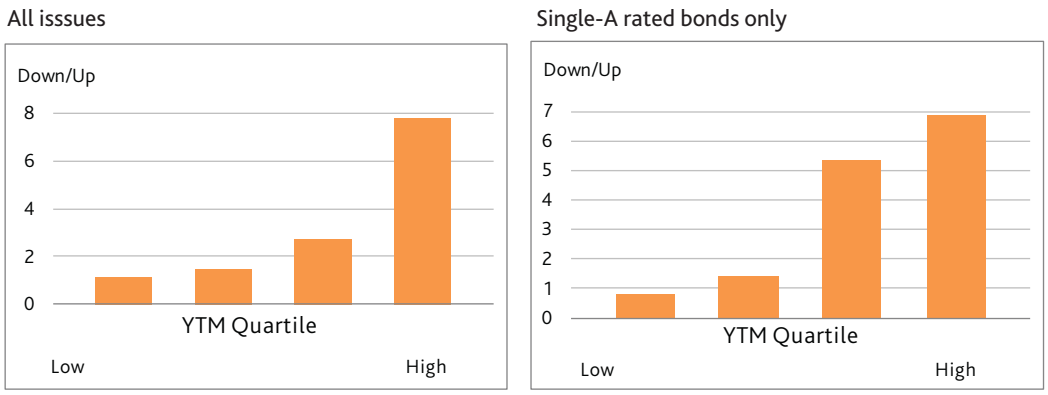
Controlling credit risk while maintaining yield

Not surprisingly, the corporate bond market is very good at identifying credit risk. One way to minimize the impact of downgrade risk on pension fund assets (we address default risk later) is to buy lower yielding, and therefore safer, bonds. This works, even when we control for the issues' credit ratings (Figure 1, for the high downgrade periods of 2000-2002 and 2008-2009). The problem is that it's essentially a yield minimization strategy – scarcely an aspirational goal for a fund manager. And if followed to its logical extreme, the strategy would mean a large increase in the amount of plan assets needed to meet the required pension payments. Further, concentrating on low risk, but low yielding, bonds would cause a disconnect between the aforementioned discount rate used to determine the present value of the pension liability and the yield on the corporate bond portfolio. This is not to mention the implications of a yield-minimization strategy for a plan sponsor's fiduciary responsibility to achieve a reasonable return for the beneficiaries.

1 As used here, "corporate" bonds refers to issues contained in corporate bond indices maintained by entities such as Barclays Capital, Merrill Lynch, Citigroup, and iBoxx. Such bonds are rated, have fixed coupons, and are mostly sold by industrial companies, financial institutions, and utilities.

2 Bond price declines usually anticipate downgrades. However, downgrades reflect deteriorations in issuer credit quality, so directionally they are aligned with falls in bond prices. The question is more one of timing.

Figure 1: US IG Corp. bond downgrade/upgrade rates ranked by bond yield quartiles (2000-2002 and 2008-2009, 10yr+ maturities)



So what plan sponsors and their advisors need is a way to limit downgrade and default risk, while still buying bonds with satisfactory yields to maturity. Public firm Expected Default Frequency (EDF™) metrics from Moody's Analytics can help them achieve this goal.

"EDF" is Moody's Analytics brand name for "probability of default". EDF metrics are derived from information about companies' capital structures and their share prices and price volatility. We publish EDFs at the entity and bond level. EDFs are available for almost all the bonds in the major corporate indices that have been sold by publicly traded issuers. The metrics incorporate market information, so they are forward-looking and always up to date (they are produced on a daily basis). EDFs are calibrated to reflect realized default rates. If, for example, there are 100 firms, each with an EDF of 1%, then experience shows that approximately one of them will default over the next year. Since firms with high EDFs have elevated levels of credit risk, it is not surprising that they are downgraded at above average rates.[3]

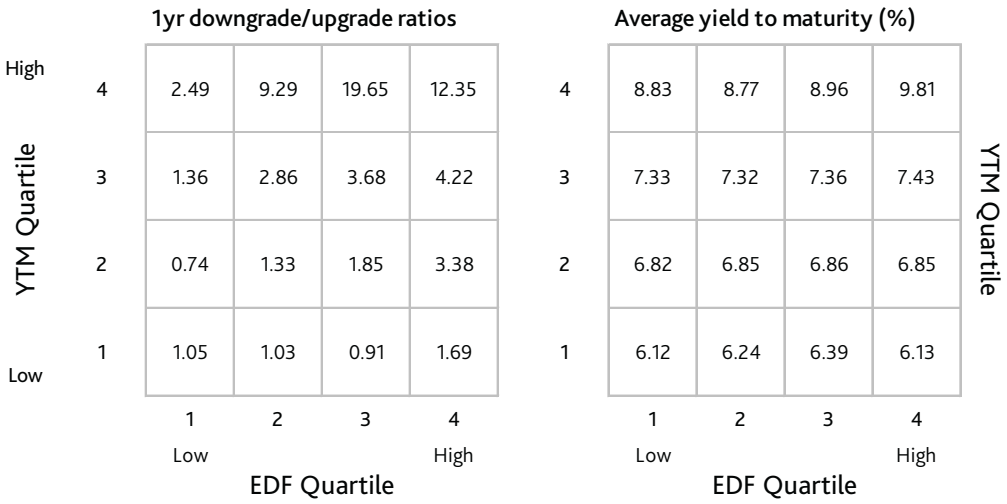
Based on the previous sentence alone, as downgrade signals EDFs would seem to be little different than yields. But this is not the case. EDFs offer a way to limit downgrade risk *while still achieving good yield and total return levels*. The second part of the statement differentiates EDFs from bond yields, and in a crucial way.

We illustrate this in Figure 2. The data consists of US investment grade bonds with 10 years or more to maturity, and covers the high downgrade periods of 2000-2002 and 2008-2009. Let's start with the panel on the left. As a first step, we divided the bond population into four buckets by the bonds' yields to maturity, with the 25% lowest yielding bonds in the bottom row and the 25% highest yielding issues in the top one. We then split each quartile row into four groupings by the bonds' EDF levels, with the lowest EDF bonds on the left and the highest on the right. Each cell contains 3,891 bonds.

3 For a description of the EDF model, please see the Modeling Methodology paper ***Public firm Expected Default Frequency Metrics: Methodology, Performance, and Model Extensions*** (Sun, Munves, and Hamilton, June 2012). EDFs and related data, including their drivers, are available via the CreditEdge website, an Excel add-in, an XML feed, and a daily data file. Moody's Analytics also produces EDFs for privately held firms. The modeling approach for private firms differs substantially from that used for publicly held firms. Private firm EDFs are available via the RiskCalc platform.

The numbers in each of the resulting 16 cells is the ratio of downgrades to upgrades over a one-year horizon on a bond count basis. Thus, for the highest-yielding quartile (in the top row), the downgrade/upgrade ratio ranges from a high of 12.35:1 (in the far right cell) to a low of 2.49:1 (on the far left). We see the same association of lower EDFs with better downgrade/upgrade ratios in the other yield quartiles rows.

Figure 2: US IG corp. bond yields and EDF levels by quartiles (2000-2002,2008-2009, 10yr+ mat.)



In this example, users of EDFs can reduce their downgrade rate by a factor of 3 in return for only a 10 bp reduction in yield

Since one row contains a quarter of the bonds when ranked by yield, it is logical to expect some difference in yields among the four cells in it. This brings us to the real question: how can EDFs help control downgrade risk while still achieving reasonable yields and returns? We answer this with the help of the right-hand panel, where the numbers in each cell represent the average yield to maturity of the bonds in it. For example, the average yield in the top-right cell is 9.81%, while that in the top-left cell is 8.83%. So during the high downgrade periods, for a 98 bp reduction in average yield, the downgrade/upgrade ratio is reduced by around a factor of five (12.35:1 to 2.49:1). The next yield quartile row presents a different trade-off. The decline in the downgrade/upgrade ratio between the right-hand and left-hand cells isn't as large (it's by around a factor of 3), but this is achieved at the cost of only a 10 bp yield reduction (7.43% to 7.33%). One can debate the reasons for the different trade-offs between these two rows. Our view is that the main driver is the "long tail" distribution of credit risk in corporate bonds. That is, downgrades and defaults are disproportionately concentrated in the riskiest securities (here ranked by EDF), so it's natural to expect the largest differentials in yields and rating change rates.

We have repeated this analysis of rating change rates/EDF ranks vs. yields/EDF ranks using data back to 1999. We have also done this for high yield bonds for the same periods. In all cases, the patterns of data behavior and the trade-offs are the same.

Figure 3: US IG corp bond 1yr annualized total returns and Sharpe Rations by YTM and EDF quartiles (2000-2002, 2008-2009)

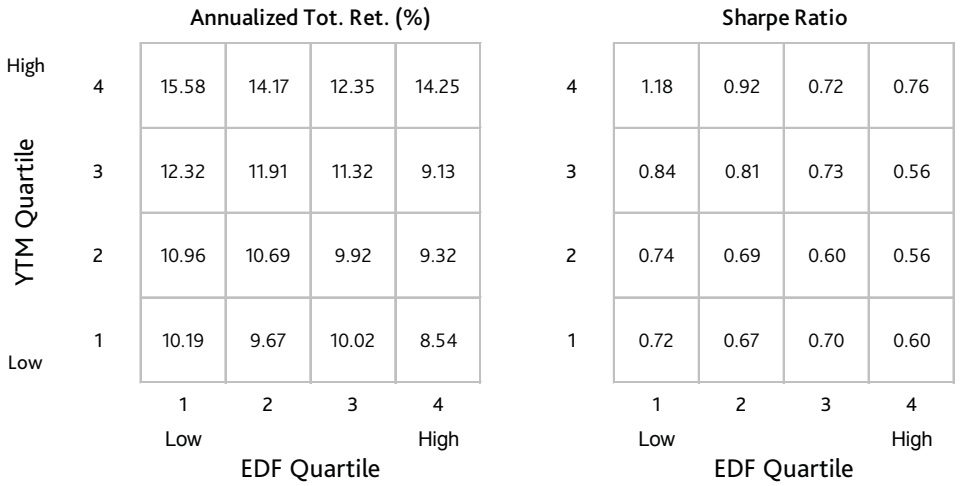


Figure 3 extends the analysis by showing the one-year average total returns and Sharpe Ratios for the same bonds used to create Figure 2, and for the same period. The top row on the left-hand panel of Figure 3 has a different, and better, pattern than what we see in the right-hand panel in Figure 2. That is, during periods of credit stress, for the top-yielding bonds, selecting issues with low EDFs (and therefore lower expected defaults) means a gain in expected total return as opposed to the give-up in yield we saw in Figure 2. A comparison of the two panels also shows that once a bondholder moves away from the top rows, their behavior becomes similar. For example, in the second row of the left-hand panel in Figure 3, bonds with lower EDFs/lower default risk have significantly higher total returns than those with high EDFs/high default risk. On a final note, the right-hand panel in Figure 3 tells us that low EDF bonds consistently have higher risk-adjusted returns.

Each investor running a liability-driven investment strategy will have different yield and return targets, as well as their own level of tolerance for downgrade risk. But for all players in the LDI space, we believe that the results in Figures 2 and 3 make a compelling case for the inclusion of EDF metrics in the decision-making process for the corporate bond portions of their pension portfolios.

An obvious question is why do EDFs provide the benefits that they do? We attempt to answer this question on page 8. But before doing so, in the next section we apply the same analytical framework to high yield data to see if EDFs can help identify bonds most at risk of default for given levels of yields and returns.

The speculative grade conundrum: the yield is nice, but the default risk is not

Traditionally, LDI strategies did not incorporate high yield bonds. The long-duration, upper investment grade discount rate used for the pension liabilities bears little resemblance to the yield on speculative grade bonds (reflecting both their higher credit risk and shorter average duration), generating a significant asset/liability mismatch on this basis alone. But things are different now: with yields low, plan sponsors and their advisors are increasingly focused on sub-investment grade issues as a way to boost the returns on their fixed income assets. However, to state the obvious, not only is high yield investing very labor-intensive, it also carries a much greater level of default risk.

As with downgrade risk control, a plan sponsor could minimize default risk by focusing on lower yielding speculative grade bonds. But this is not really a valid alternative -- it would defeat the purpose of investing in high yield issues in the first place. Just as EDF metrics can help plan sponsors minimize downgrade risk while maintaining yield, they can also help avoid defaults while achieving target yield and return levels.

Figure 4: US HY corp bond def. rates and EDF level by quartiles (2000-2002, 2008-2009, 3yr+ mat.)

1yr default rates

YTM Quartile	1 (Low)	2	3	4 (High)
4 (High)	4.4%	7.4%	6.1%	13.0%
3	0.2%	0.1%	1.3%	1.1%
2	0.0%	0.1%	0.1%	0.5%
1 (Low)	0.0%	0.0%	0.0%	0.3%

EDF Quartile

Average yield to maturity

YTM Quartile	1 (Low)	2	3	4 (High)
4	15.78	15.55	17.00	21.15
3	10.14	10.43	10.50	10.42
2	8.74	8.70	8.77	8.77
1	7.40	7.51	7.62	7.65

EDF Quartile

Figure 4 is constructed much like Figure 2. The time periods covered are the same. However, the assets carry speculative grade ratings from Moody's or S&P, and the bonds have maturities of three years or more, rather than 10+ years.[4] The figures in each cell in the left-hand panel are the one-year default rates on a bond count basis, rather than downgrade/upgrade ratios.

Default rates are strongly associated with yield levels, as one would expect (the numbers in the left panel are higher in the upper rows). As with Figure 2, within each row the EDF data is highly informative. For example, in the top row, the default rate in the far right-hand cell is three times that in the far left-hand cell. On the downside, amongst the riskiest bonds, the yield give-up that comes with the lower EDFs/ lower default rates is substantial. Sticking with the top quartile, the right panel shows that during the crisis periods a plan sponsor would give up 5.37% in yield (21.15%-15.78%, in the far right and far left cells) in order to cut his or her the default rate by 8.6 percentage points (13.0% to 4.4%). But much like in Figure 2, the trade-off between lower credit risk and yield reduction is more palatable in the other three rows. For example, in the second row from the top, moving from the far right cell to the far left cell reduces the default rate by a factor of 5.5 times (from 1.1% to 0.2%), for only a 28 bp fall in average yield (10.42% to 10.14%).

4 Plan sponsors pursuing LDI strategies prefer long duration assets. These are rare in the high yield class. Our choice of three-year or greater maturity bonds avoids very short duration securities.

As we did with the investment grade exercise, in Figure 5 we analyze annualized total returns and Sharpe Ratios for high yield bonds, divided by yields and EDFs, again for periods of credit crisis. The left-hand panel shows that for the highest yielding bonds, bondholders would suffer a very significant give-up in total return if they held lower EDF bonds than issues with high EDFs (22.87% vs. 39.74%). This is to be expected: the top right-hand bucket is packed full of cheap issues that, in the subsequent 12 months, either defaulted at somewhat lower prices or recovered strongly. In other words, for issuers of such bonds it was a case of "fly or die". And enough flew, so to speak, to allow the cohort to perform very well indeed.

Figure 5: US HY corp bond 1 yr annualized total returns and Sharpe Ratios by YTM and EDF quartiles (2000-2002, 2008-2009)

But a very different picture emerges when we move down the rows in the left-hand panel of Figure 5. Let's take the second row from the top as an example. Per Figure 4, the bonds in the left-hand bucket defaulted at a 0.2% rate, compared to a 1.2% rate for their counterparts on the far right. Yet in Figure 5 we see that the low EDF/low default bonds had an average one-year total return of 13.23%, compared to 10.17% for their high EDF/high default rate counterparts.

We have carried out the same analysis in Figures 5 and 6 for periods when the default rates are lower. We see the same patterns in the results for such timeframes, although the order to the results isn't as regular, especially in the lower yielding buckets, due to a paucity of defaults/downgrades.

Default risk: an under-analyzed aspect of corporate bond investing

We now come to the crucial question: what allows EDFs to identify corporate bonds with low downgrade or default risk, but with good yield and return characteristics?

We believe the answer is that many corporate bond investors do not analyze bond PDs in a systematic way. We realize that this is a bold statement: credit risk is very well understood by market participants, and is indeed central to high yield analysis. Another point is that default is usually a remote possibility for investment grade issuers, so it seems odd to consider it as a driver of bond prices.

Nonetheless, the evidence in this paper shows that probability of default data, in the form of EDFs, can add value to corporate bond investment processes. So how do we reconcile the gap between investors' knowledge of credit and focus on such risk, and the value added by EDFs? We think the answer is that it is one thing to keep credit risk "in mind" when analyzing high grade investments, or to come up with estimated default rates for selected, deeply discounted speculative grade bonds. It is a different matter to utilize quantitative PD metrics that are consistent across time, country, and types of entities, and that are available on tens of thousands of issues. Moreover, EDFs are produced by a state-of-the art model, one that has been tested and refined for over 20 years. It is for these reasons that we believe pension plan sponsors and their advisors who utilize EDFs in their investment strategies can gain a crucial informational advantage.

Conclusion

Liability-driven investing is scarcely a new concept, and has been successfully employed over the years by many plan sponsors and fund managers. But challenges remain, including the need to minimize credit and default risk in corporate bond investments while maintaining yields and returns. This will come into sharper relief when risk levels rise -- as they inevitably will. We believe that by providing a way to control downgrade and default risk while still buying bonds with above-average risk-adjusted performance characteristics, public firm EDFs will increasingly be used to inform decisions around corporate bondholdings.