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## Dealing with Fallen Angel Risk

Fallen Angel risk results from the possibility and price impact of bond downgrades from investment grade (IG) into high yield (HY). We find that the price deterioration experienced by bonds of future Fallen Angels is significantly greater than the price deterioration experienced by bonds of future IG downgrades on average. As of Q1 2019, over 50% of investment grade bonds in the US and globally by amount outstanding are rated Baa, so that a near-term recession could cause the incidence of Fallen Angels to rise substantially. In light of these circumstances, we test the early warning power of the CreditEdge Deterioration Probability (DP) metric for Fallen Angel downgrades, and find it well-suited for this purpose. DP quintile portfolios exhibit monotonically increasing rates of Fallen Angel downgrades, and we find that historical underperformance by high DP versus low DP bond portfolios is exacerbated during market downturns.

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## Introduction

Fallen Angel risk is a major concern for fixed income investors—especially those with significant positions in bonds rated in the lower end of the investment grade spectrum. As noted recently by the Bank for International Settlements, investment grade corporate bond funds have increased the share of BBB/Baa bonds in their portfolios significantly since the Global Financial Crisis, from roughly 20% in 2010 to about 45% in both the US and Europe in 2018 (BIS, 2019). Many funds are obligated by their mandates to exit all positions in bonds downgraded into high yield. Selling pressure associated with this effect likely contributes substantially to the price impact such instruments typically experience in the period leading up to downgrade.

For these reasons, investors are especially keen to assess creditworthiness of investment grade companies that are at risk of falling into high yield territory over the next 12-18 months. The problem has more material importance than ever: Baa-rated bonds now account for half of the investment grade corporate index, whose total amount outstanding currently hovers around \$5 trillion<sup>1</sup>. The fate of Baa issuers is poised to set the tone for both investment-grade and junk markets during the next few years. In particular, there's concern that the ranks of Fallen Angels could grow in the coming months, especially if and when the U.S. economy moves toward recession.

In this article, we apply a risk metric, the Moody's Analytics Deterioration Probability, to the prediction of Fallen Angels and investment strategies designed to reduce Fallen Angel risk. The Deterioration Probability, or DP for short, was designed to predict downgrades within the 12 month horizon for issuers across the ratings scale (Malone, Baron, and White, 2018). In this article, we show that it proves useful for the narrower problem of Fallen Angel prediction, as well as the basis for simple investment strategies designed to reduce Fallen Angel risk.

To illustrate the potential value of the DP with an example, we highlight one of the most notable Fallen Angels to kick off 2019: the recently-defaulted California utility firm Pacific Gas & Electric.

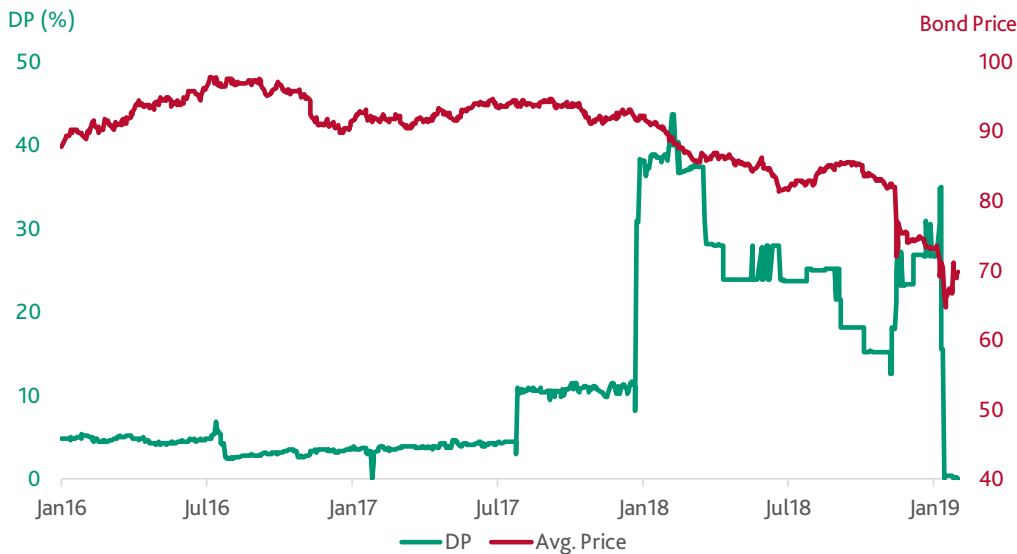
On January 29, 2019, PG&E declared bankruptcy under Chapter 11 of the U.S. Bankruptcy Code. In the run-up to this event, Moody's Investors Services downgraded PG&E to Baa3 on November 15, 2018, and further downgraded the firm's senior unsecured rating to Ba3 on January 10, 2019, just under three weeks prior to the bankruptcy filing. The Deterioration Probability for PG&E jumped from around 10% to around 40% several months before these events, on January 1, 2018, and remained at elevated levels up until just before the firm's eventual default.

To assess the relationship between the bond prices of the firm and the DP signal, Figure 1 below plots the Deterioration Probability and the average price of the approximately 41 bonds outstanding versus time for PG&E during the three year period from January 2016-January 2019 inclusive.

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<sup>1</sup> As of March 2019, Bloomberg Barclays US Corporate Bond Index

Figure 1. Deterioration Probability and Average Bond Price\* versus Time for PG&E



\*Average price of 41 bonds

After moving in a bounded range from \$90-\$100 during the years 2016 and 2017, the average bond price for PG&E Company breached the \$90 threshold in late February 2018 and continued to trend downward steadily until plummeting in the months immediately preceding the firm’s default this year. Had investors in these bonds reduced or sold out of their positions following the signal sent by the DP metric in January 2018, they might have avoided substantial losses on their holdings of PG&E debt. Of course, PG&E provides but one example of the DP’s performance at the task of early detection of Fallen Angel risk. To validate the metric for Fallen Angel prediction, we now turn to a more systematic analysis of its predictive power.

### The Dataset

To examine Fallen Angel risk historically, we employ an issuer-level dataset covering the time period from January 2004 to September 2016. For some figures, such as those involving time series, we extend the results to 2019. The analysis in this paper is based on rated firms, and we used our monthly DP and ratings data to derive results. On average, there are about 988 investment grade issuers in the sample, of which 547 are rated Baa.

For analysis done at the issue (bond) level, we examine the US Investment Grade (USIG) and Europe Investment Grade (EUIG) markets separately, using a related dataset. The CreditEdge bond-level dataset contains information from approximately January 2007 to June 2018. During this period, the monthly average numbers of covered bonds were 3,169 for the USIG market and 1,270 for the EUIG market, respectively.

The main metric we employ for Fallen Angel early warning from the CreditEdge suite is called the Deterioration Probability (DP). The Deterioration Probability (DP), as documented in Malone, Baron, and White (2018), is a model-driven estimate of the 1-year probability of downgrade or credit quality deterioration for public firms. This measure complements the Expected Default Frequency (EDF), which is Moody’s Analytics’ CreditEdge metric for the default probability for public firms, as documented in Pooya and Dwyer (2015).

## Fallen Angel Risk Rising

To measure the current magnitude of Fallen Angel risk, Figure 2 plots the amount outstanding of U.S. and global Baa-rated debt as a fraction of the amount outstanding for all U.S. and global investment grade debt, respectively, at the issue level.

Figure 2. Baa-rated Debt as Fraction of Investment Grade Debt: 2004-2019\*

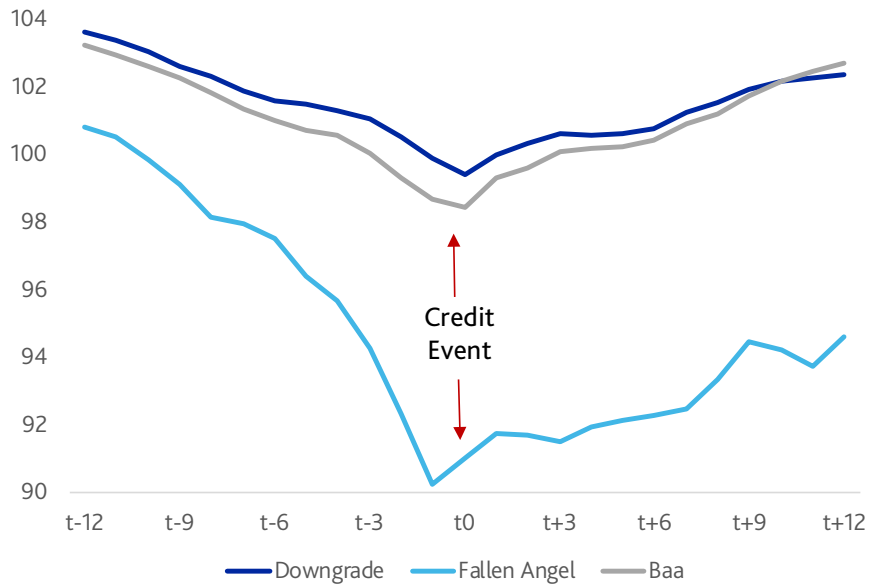


\*Weights are based on the total amount outstanding of the Baa debt expressed as a fraction of total USIG amount outstanding in the Barclays Bloomberg index.

The results are striking: Baa-rated bonds now comprise over 50% of the IG market weight at the issue level in the US and globally, and both fractions have trended upward significantly since the Global Financial Crisis. A prolonged continuation of these trends would likely put many institutional investors in the situation of having to hold investment grade debt that they would be obligated to sell following a 1-notch or 2-notch downgrade. As the incidence of downgrades tends to spike in periods of market turmoil (Malone, Baron, and White, 2018), such simultaneous selling pressure on the part of many large institutions could have significant effects on the market prices of the bonds involved during the next recession.

As the risk of becoming a Fallen Angel rises for a particular bond, investors often sell pre-emptively. Figure 3 below plots the average bid price for bonds surrounding three types of downgrade events: IG downgrades in general, Baa downgrades, and Fallen Angel downgrades. The timeline covers the period 12 months before the event, the month of the event, and 12 months following the event.

Figure 3. Average bid prices for bonds around selected credit events for IG issuers: 2007-2018



The main conclusion conveyed by Figure 3 is that Fallen Angel downgrades are different. In particular, the market impact on the price of IG bonds downgraded into high yield during the 12 months prior to the Fallen Angel event is significantly larger than for the average IG or Baa downgrade. The average price path for bonds prior to all of the three downgrade events indicates that bond investors tend to anticipate such credit events in advance and likely sell pre-emptively as the probability of downgrade rises. Still, we can infer from the “Baa” line above that a 1-notch downgrade of a Baa1- or Baa2-rated bond has mild negative return implications compared to the impact of a downgrade into high yield.

### Results on the early warning power of the Deterioration Probability for Fallen Angels

Having put the magnitude of the problem in perspective, let’s evaluate the CreditEdge Deterioration Probability as a potential solution for quantifying Fallen Angel risk.

To assess the early warning power of the DP for Fallen Angels, we start with a simple sorting strategy. Specifically, at the end of each month, we sort the set of global investment grade issuers in increasing order by their DP values and then tabulate the downgrade and Fallen Angel outcomes for each issuer during the 12 months following the DP measurement date. A Fallen Angel outcome is defined as an issuer whose rating is investment grade at the time of measurement but high yield at some point over the 12 month time horizon.

The results of this exercise are shown in Figure 4. Figure 4a reports results for downgrade outcomes, and Figure 4b reports results for Fallen Angels. Bucket D1 corresponds to issuers with the lowest 20% of DP levels, whereas bucket D5 contains the top quintile of issuers by DP. As is apparent in Figure 4a, 32% of the issuers in bucket D5 experienced downgrades during the next 12 months. Meanwhile, only 2.6% of the issuers in bucket 1 (D1) were downgraded within the same time frame.

Turning to the Fallen Angel results in Figure 4b, we find that 7.8% of the issuers in group D5 fell into high yield territory during the 12-month horizon, while only 0.7% of the issuers in bucket D1 became Fallen Angels. The relationship between downgrade/Fallen Angel outcomes and quintiles is monotonic.

**Figure 4. 12-month downgrade and Fallen Angel frequencies by DP quintile\***

Figure 4a. Downgrade Frequency by DP

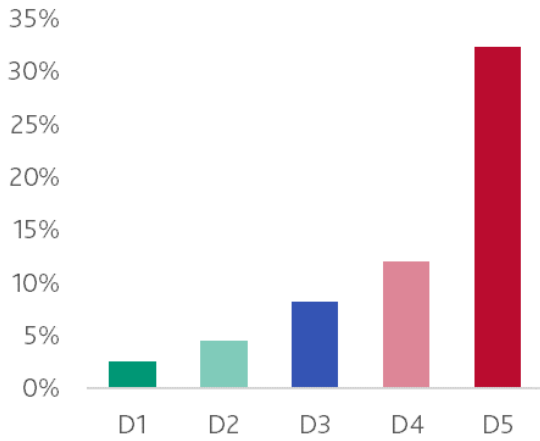
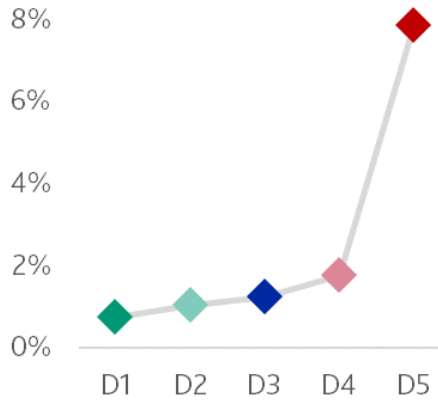


Figure 4b. Fallen Angel Frequency by DP

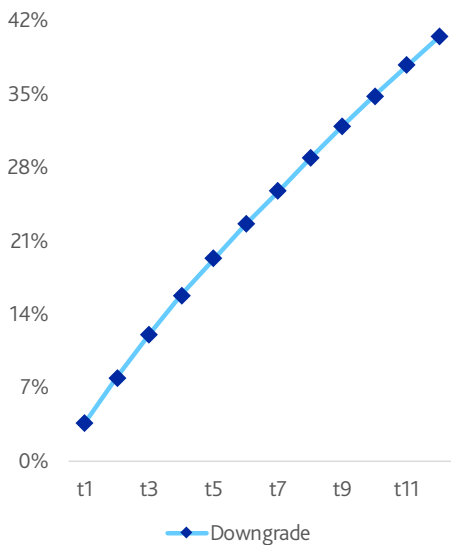


\*Based on data during the period from January, 2004 – July, 2016

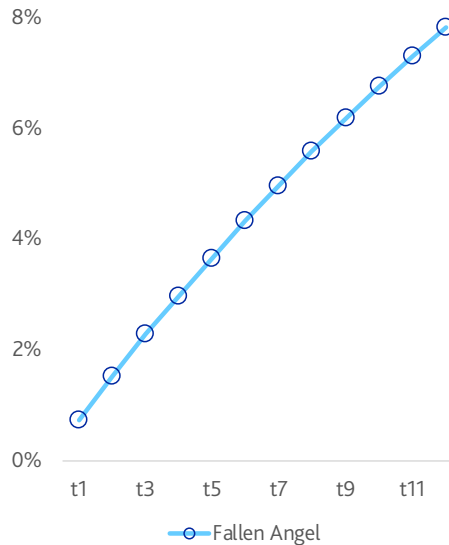
To extend these results, Figure 5 shows the cumulative distributions of downgrades and Fallen Angels by horizon from 1 to 12 months for firms whose DP passes the 80<sup>th</sup> percentile threshold at a given point in time. This set corresponds to issuers that are in group D5 within their cohort. Intuitively, averaging across the credit cycle, we would expect about the same fraction of downgrade events to occur each month during the 12 month window, as the dependent variable for the DP model is a dummy variable for a downgrade having occurred in any of the next 12 months. This is indeed the pattern we encounter in Figure 5a. In addition, in Figure 5b, we can observe that the frequency of Fallen Angel events is roughly one-fifth that of downgrades in general among IG issuers.

**Figure 5. Cumulative Downgrade and Fallen Angel Frequencies for the Highest DP Quintile – Global IG\***

5a. Cumulative Downgrade Frequency



5b. Cumulative Fallen Angel Frequency



\*Based on the period from January, 2004 – July, 2016. Note that the 12-month horizon cumulative downgrade frequency reported in the left panel above is greater than the 12-month downgrade frequency reported for group D5 in Figure 4. This result arises because Figure 5a counts multiple downgrades for the same issuer as separate events.

In order to use the DP as an early warning signal in the months leading up to a possible Fallen Angel, it is useful to have a sense of the typical path followed by the DP for investment grade issuers that are ultimately downgraded into high yield. To shed light on this point, Figure 6a plots the average DP in each of the 24 months leading up to a Fallen Angel event for the set of 352 Fallen Angel downgrades in our sample. For Fallen Angel events timestamped at month  $t$ , we find that the DP rises from around 17% in month  $t-24$  to just over 32% in month  $t-1$ . Thus, on average, the DP metric for an investment grade issuer doubles during the two years prior to becoming a Fallen Angel. This finding is in line with the findings of the previous research (Malone, Baron, and White, 2018) for downgrade events in general. The path of the median DP, shown in Figure 6b, is shifted slightly lower compared to the mean path in Figure 6a but otherwise exhibits similar characteristics.

Figure 6. Run-up to Credit Event – DP versus Time for Global IG Issuers\*

Figure 6a. Average

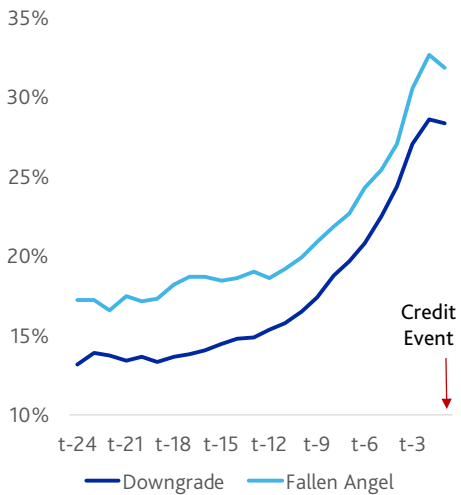
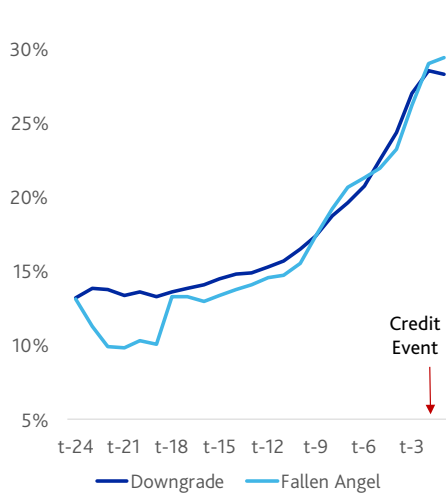


Figure 6b. Median



\*Based on the period from January, 2004 – July, 2016. This plot depicts the mean DP level at each time horizon prior to event for the set of downgrades and Fallen Angel events in our sample of investment grade firms.

Figure 7. Run-up to Credit Event – DP Percentile in Cohort versus Time for Global IG Issuers\*

Figure 7a. Average

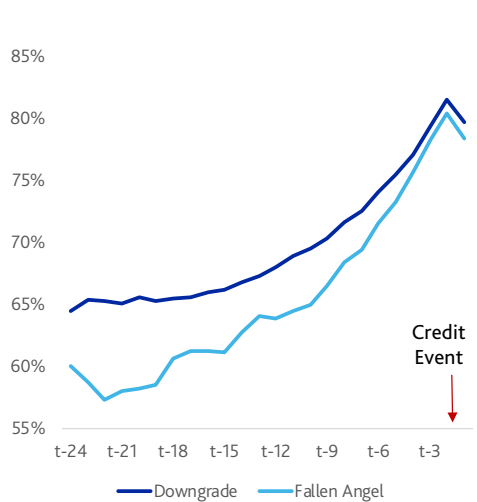
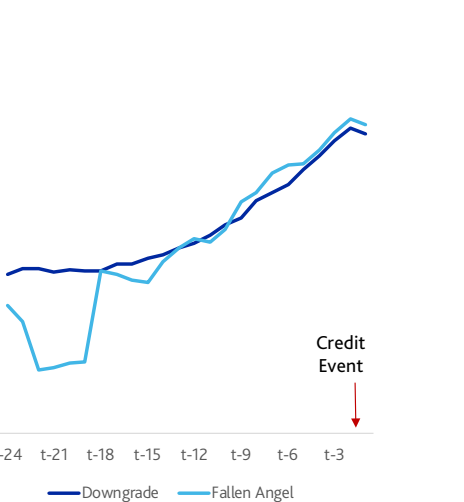


Figure 7b. Median



\*Based on the period from January, 2004 – July, 2016. This plot depicts the mean DP percentile at each time horizon prior to event for the set of downgrades and Fallen Angel events in our sample of investment grade firms.

In risk monitoring and early warning systems, it is common to use percentile-based thresholds for risk metrics as a criterion for when to take further remedial action, such as exiting, reducing, or hedging a position. Figure 7a plots the average DP percentile in the cross-section of issuers during the 24 months prior to downgrade. Twenty-four months prior to its downgrade into high yield, the average “before-the-fall” investment grade issuer has a DP in the 60<sup>th</sup> percentile of the cross-sectional distribution. This figure rises to around the 80<sup>th</sup> percentile 1-2 months prior to downgrade. Figure 7b plots the median DP during the same timeframe in the run-up to Fallen Angel events. We find that the median DP percentile for Fallen Angels breaches 80% around 9 months prior to downgrade into high yield, which would provide a sufficient window of time in which to take action.

As a final result on the predictive power of the DP metric for Fallen Angel downgrades, let’s examine the rates of type 1 and type 2 forecasting errors we obtain using the 80<sup>th</sup> percentile rule discussed above.

Figure 8. Confusion matrices for 6-month and 12-month horizons: Fallen Angel prediction

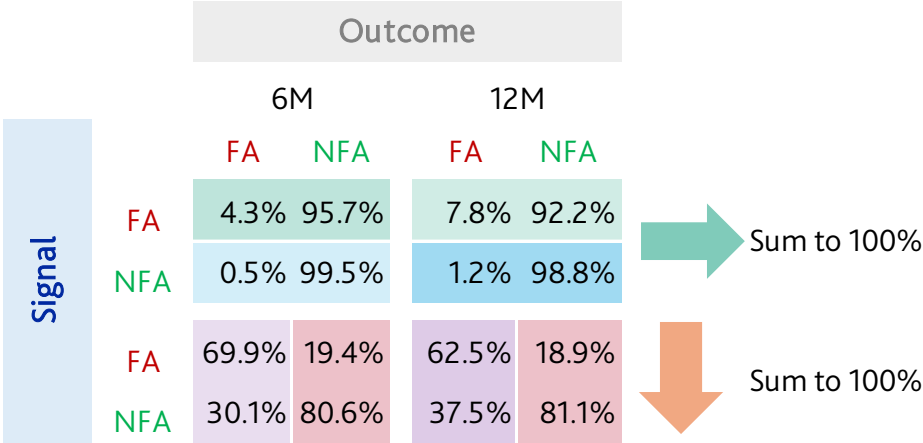


Figure 8 displays Confusion Matrices for 6 month and 12 month forecasting horizons in the bottom rows, with the top rows displaying matrices whose row sums, instead of column sums, have been normalized to 100%. The signal columns (Fallen Angel or No Fallen Angel prediction) are shown in the left-hand side, with the outcome columns on the horizontal axis.

The results of Figure 8 indicate that for the 12 month prediction horizon, 62.5% of Fallen Angel downgrades are predicted correctly and 81.1% of non-FA events are predicted correctly, with a false positive rate of 18.9%. At the 6-month horizon, 70% of Fallen Angels are predicted correctly using the 80<sup>th</sup> percentile threshold rule, at the cost of a 19.4% rate of false positives.

It’s worth doing some back-of-the envelope spread math to illustrate the value of the tool. In the US investment grade universe, as of April 18, 2019 on the Bloomberg terminal, the market-weighted average spread in the Barclay’s Bloomberg index stands at 112bps. If we order bonds by issuer DP and split the sample into two groups based on the 80<sup>th</sup> percentile DP cutoff at the bond level, we find that the “High DP” bond group has a weighted-average spread of 118bps and that the “Low DP” group, consisting of 80% of the bonds in the index, has a weighted-average spread of 111bps. Filtering out the highest 20% of bonds by DP, in other words, only results in a spread (or approximately, yield) slippage versus the index of 112 – 111 = 1bp. Using the top panel of Table 8, whose rows sum to 100%, we can calculate a rough estimates of the expected net gain from filtering. From Figure 3, we know the average price return impact of a Fallen Angel event is around (91-101)/101 = -990bps during the year leading up to the event. Assuming a flat yield curve and constant spreads, the net benefit of sorting and reweighting would then be approximately:

$$-1bp + ((1.0) * (1.2%) - ((0.80) * (1.2%) + (0.20) * (7.8%))) * (-990bps) = 12bps$$

The benefit from avoiding more Fallen Angels greatly outweighs the 1bp yield slippage by a factor of 13 to 1. Except for the 1bp yield slippage figure, which draws upon the USIG market data at a point-in-time, the rest of the figures in the above calculation are based on global IG market data. Nonetheless, the calculation is useful and actually understates the magnitude of the expected return difference, including yield slippage, between the lower 80 and upper 20<sup>th</sup> percentile groups sorted by DP, which would be



$$\begin{aligned}
 & -7\text{bps} + (-990\text{bps}) * (1.2\% - 7.8\%) \\
 & = 58\text{bps}
 \end{aligned}$$

This estimate of 58bps of lost total expected return illustrates the nontrivial material difference between the top quintile by DP and the rest of bonds in the index.

### Investment strategy implications

Now that we have provided evidence of the DP's value as an early warning tool for downgrades of investment grade issuers into high yield, we close by focusing on the potential for the use of the DP as part of an investment strategy. Figure 9 plots the OAS vs. EDF and OAS vs. DP correlations for USIG and EUIG markets over a period of 11 years, from 2007 to 2018.

Figure 9. The Pearson correlation between OAS vs. EDF and OAS vs. DP

Figure 9a. US Investment Grade



Figure 9b. European Investment Grade



On average, the correlation between OAS and EDF is 0.4, while that of OAS and DP is 0.2. The main result of Figure 9 is that, because the DP is less correlated with the OAS than the EDF, sorting and screening IG bonds by their issuer DP leads to less yield slippage than would an equivalent screen based on the EDF.

Finally, we present a couple of backtest results for simple DP-based strategies in USIG and EUIG markets. These results are shown in Figure 10, with USIG results in Figure 10a and EUIG results in Figure 10b. Each strategy assumes trading at the monthly frequency, and sorts the universe of securities into 5 duration buckets prior to sorting by the DP metric within each bucket to form portfolios.

Figure 10. Cumulative total returns, high DP vs. low DP

Figure 10a. US Investment Grade

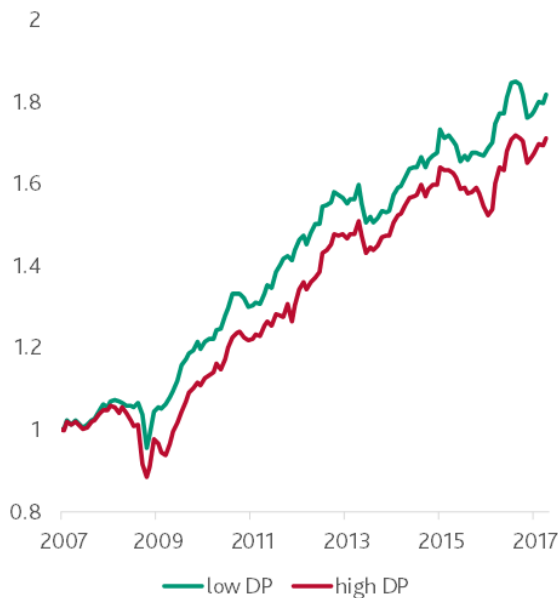
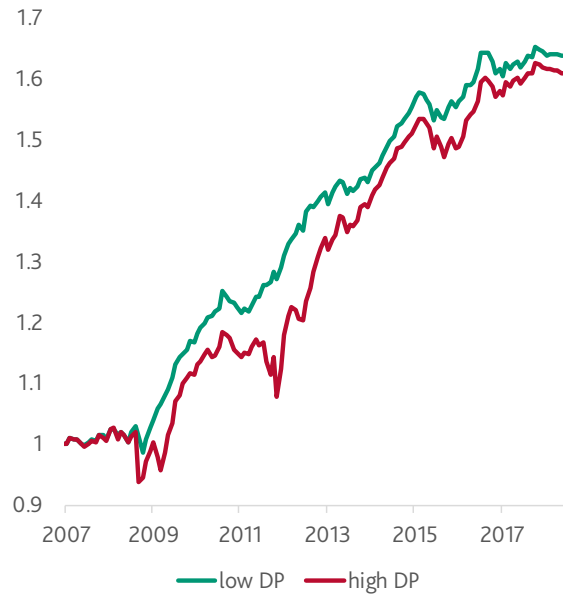


Figure 10b. European Investment Grade



From Figure 10, we see that low DP portfolios outperform high DP portfolios through the credit cycle, in part due to experiencing lower drawdowns during market stress periods.

## Conclusion

Fallen Angel risk is rising in global fixed income markets, and unanticipated Fallen Angel downgrades have material adverse consequences for fixed income portfolios. We validate the use of the Moody's Analytics Deterioration Probability metric for early detection of Fallen Angel downgrades, and find the tool to be useful for this purpose. Simply strategy backtests based on DP sorts reveal that low DP investment grade bond portfolios in the US and Europe have tended to outperform high DP bond portfolios through the business cycle, with outperformance concentrated in periods of market stress.

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