INVESTING IN FALLEN ANGELS

Capacity, Transaction Costs, and the Bond-CDS Basis

Introduction

Just over a year ago, we presented a detailed analysis of the characteristics and price dynamics of fallen angels during the three-year period around their downgrade.[1] Using a comprehensive sample spanning 20 years and more than 1,400 bonds that migrated from investment grade to non-investment grade status, we documented strong price reversal patterns at the aggregate level. Our results indicated that investors started to liquidate the soon-to-become fallen angels even before the actual rating change, a process that peaked about three months after the downgrade. As the selling intensity dissipated, price declines reversed, and fallen angels outperformed high yield peers with similar characteristics for up to two years. In the cross-section, the magnitude of price recovery of individual issuers was inversely related to their initial underperformance.

We discussed the implications of our findings for investors benchmarked to the Barclays Capital Corporate Index and examined several rule-based strategies that total-return managers might employ to exploit the price patterns we uncovered. Using rules based on time relative to the downgrade event and a "rich"/"cheap" indicator, we found that a portfolio of fallen angels outperformed its high yield peers by an average of 8.5% per year, with information ratios in excess of one. The outperformance was not confined to a specific period but was evident throughout the sample.

In this article, we report updated performance figures for our rule-based strategies and address a number of inquiries we received from investors following publication of the original study. The first part of this paper examines the performance stability of fallen angels over time and across markets, and possible explanations for the profitability of the 3-Month Reversal strategy. Specifically, how much variation is observed in the outperformance of fallen angels over peers? Is the price pressure experienced by fallen angels limited to the U.S. corporate market or is it also evident in the European market? To what extent does the performance of the 3-Month Reversal Strategy reflect a general pattern of mean-reversion in the high yield market and is its superior return a result of higher default rates (relative to other high yield bonds)?

Arik Ben Dor
+1 212 526 7713
arik.bendor@barcap.com

Yael Eisenthal Berkovitz
+1 212 526 4086
yael.eisenthal-berkovitz@barcap.com

Jason Xu
+1 212 526 6782
jason.xu@barcap.com

www.barcap.com

[1] Ben Dor, A. and J. Xu. *Fallen Angels: Characteristics, Performance, and Implications for Investors*, Barclays Capital, December 2010.

The second part focuses on implementation issues resulting from the unique characteristics of fallen angels. The supply of fallen angels varies considerably. Thus, the capacity of a strategy investing only in fallen angels may be limited. Moreover, the impact of transaction costs on the performance of such a strategy is likely to be larger than usual. Forced selling, which drives the price reversal patterns, also makes fallen angels less liquid relative to other high yield bonds (which does not necessarily mean lower volumes, but rather higher bid-offer spreads). Furthermore, periods in which overall supply of fallen angels is high and resulting initial underperformance is large often coincide with a decrease in overall market liquidity.

We investigate both issues in turn. First, we examine what is a realistic size for a portfolio of fallen angels. Specifically, we study how the performance of our rule-based strategies varies with portfolio size when positions in individual issuers are constrained to a set fraction of their amount outstanding. Second, we incorporate bond level bid-ask spreads based on Dastidar and Phelps' (2009) Liquidity Cost Scores into the calculation of strategy returns. This gives us a more accurate read on the actual returns that can be expected when investing in fallen angels, especially given the relative illiquidity in the sub-period for which LCS data are available (since 2007) relative to the overall sample since 1991.

The fallen angels strategies discussed in our original study significantly outperformed peer high yield bonds during the sample period but required investors to purchase fallen angels' bonds outright. This may be appropriate for high yield managers, who can substitute exposure to one universe of high yield bonds (for example, originally issued) with another (fallen angels). However, many investors may want to benefit from the temporary dislocation in the pricing of fallen angels without taking on the systematic and idiosyncratic credit risks associated with holding a limited number of high yield bonds.

An alternative strategy would be to trade the bond-CDS basis of fallen angels. Credit default swaps are not subject to the same investment constraints that spur managers to sell fallen angels once they are excluded from their benchmark index. Thus, CDS spreads should widen by less than bonds after downgrade, and the basis should also exhibit mean reversion, widening initially and then gradually converging to its long-term equilibrium level. The last part of the paper investigates a rule-based strategy designed to benefit from mean reversion in the bond-CDS basis of fallen angels. We track the characteristics and performance of such a strategy from 2004, using more than 100 individual issuers. Consistent with past results, we find that over 85% of pairs earn positive returns, with average gross and net (after transaction costs) Sharpe Ratios in excess of 3 and 1.7, respectively. We conclude with a short discussion of the implications of our findings for investors.

Revisiting the Performance of Fallen Angels: Stability, Mean Reversion, and Default Rates

Ben Dor and Xu (2010) introduced three rule-based dynamic portfolios of fallen angels with different construction methodologies. The "Buy All" portfolio was meant to capture the collective performance of fallen angels, and therefore acquired all bonds at the end of the downgrade month and held them for up to 24 months. A second portfolio, "3-Month Reversal", purchased only the subset of bonds that were trading at spreads of at least 40bp over high yield peers three months after downgrade (once forced selling had on average subsided). In addition, bonds were sold from this portfolio prior to the end of the holding period if their relative spread to peers declined to zero. In the last portfolio, "Flexible Reversal," bonds were purchased any time in the first six months after downgrade, once their relative spreads were higher than 40bp, as before, but had also tightened, compared with the previous month. The last condition was meant to be an indicator that the selling imbalance caused by the downgrade had mostly dissipated.[2]

[2] For complete details on the construction methodologies, see Ben Dor and Xu (2010), pages 20-22.

Throughout the article, we focus on the 'Buy All' and '3-Month Reversal' strategies because the former reflects the performance of the entire universe of fallen angels, whereas the latter consistently generated the best returns of the three strategies.

Performance Update

We begin with an update on the performance of the 'Buy All' and '3-Month Reversal' strategies since publication of our original study. Figure 1 shows various performance statistics for the two strategies between July 2010 (the first month after the end of the original sample period) and December 2011. To facilitate comparison, the table also displays the same statistics for January 1991-June 2010, as reported in the first study.

Figure 1: Performance Statistics for the 'Buy All' and '3-Month Reversal' Strategies

	Buy All			3-Month Reversal		
	Portfolio	Peer Group	Ret. over Peer Group	Portfolio	Peer Group	Ret. over Peer Group
July 2010-December 2011						
Avg. return (Monthly)	0.77%	0.88%	-0.10%	0.86%	0.61%	0.25%
Std. return (Monthly)	2.29%	2.26%	1.11%	1.30%	1.22%	0.47%
Sharpe/Inf. Ratio (Ann.)	1.14	1.31	-0.32	2.25	1.67	1.88
% of Positive Months	72.2%	72.2%	50.0%	77.8%	72.2%	66.7%
Avg. portfolio population	37.6			4.3		
Avg. portfolio cash position	0.0%			56.7%		
January 1991-June 2010 (Ben Dor and Xu (2010) study)						
Avg. return (Monthly)	1.04%	0.73%	0.31%	1.46%	0.67%	0.78%
Std. return (Monthly)	2.77%	2.14%	1.68%	3.83%	2.11%	2.62%
Sharpe/Inf. Ratio (Ann.)	0.87	0.64	0.64	1.01	0.56	1.03
% of Positive Months	73.08%	75.21%	58.55%	75.64%	77.78%	63.25%
Avg. portfolio population	47.1			11.7		
Avg. portfolio cash position	1.6%			30.8%		

Note: The return to a peer group was computed by equally weighting the performances of all peer groups for a portfolio's constituents. For more details, see Ben Dor and Xu (2010). Sharpe Ratio was calculated using the 1-month Libor rate. Information ratio is the ratio of average to standard deviation of returns over peers.
Source: Barclays Capital

The '3-Month Reversal' strategy continued to outperform a peer group of high yield bonds matched by rating, industry and maturity, achieving positive relative returns in 66.7% of the months. The decline in relative returns (25bp/month versus the long-term average of 78bp/month) was more than offset by a commensurate decrease in volatility, resulting in a higher information ratio (1.88 compared with 1.03 in the original study).

In absolute terms, however, the performance of the '3-Month Reversal' strategy since July 2010 was only about half its long-term average (0.86% versus 1.46% per month). Furthermore, although in the original study the superior relative performance of '3-Month Reversal' relative to that of the 'Buy All' strategy stemmed from higher absolute returns, since July 2010 both strategies have generated fairly similar performance (0.86% and 0.77% per month, respectively). The fact that the relative performance of the '3-Month Reversal' strategy was still higher than that of the 'Buy All' strategy was mostly a result of the lower returns of its peer group.

At first, this seems to indicate that the ability of the '3-Month Reversal' strategy to identify the subset of fallen angels with the best prospects for price reversal has deteriorated. However, the portfolio composition of both strategies suggests another explanation. Since July 2010, the '3-Month Reversal' portfolio has included only 4.3 bonds, on average, versus 37.6 bonds in the 'Buy All' strategy. Because of the position size limit per individual issuer (10%), more than half of the portfolio (56%) remained in cash, as opposed to the 'Buy All' portfolio, which was fully invested. Hence, the '3-Month Reversal' strategy earned a higher return than the 'Buy All' strategy, even though less than half of its capital was deployed, which also accounts for its substantially lower volatility. Notice also that the size of the recent cash position was almost double that of the long-term average (56.7% versus 30.8%, respectively). If we scale recent returns to reflect the difference in capital actually deployed (multiplying by the inverse ratio of the non-cash positions), we end up with a figure quite similar to the strategy absolute performance in the original study (1.37% versus 1.46% per month, respectively).

Unlike the '3-Month Reversal' strategy, the 'Buy All' strategy underperformed its peer group since July 2010 by 10bp/month. However, given the short length of the update period and the magnitude of the difference, the results do not necessarily indicate a change to our earlier findings, as short periods of mild underperformance were observed in earlier periods (see the 1-year cumulative performance between 1995 and 1999 in Figure 2).

Stability and Geographical Scope

Although the performance variability of the '3-Month Reversal' strategy declines significantly once it is adjusted to reflect the portfolio cash position, it highlights a more general question regarding the stability (or lack thereof) of fallen angels recovery after the downgrade. To examine this issue, Figure 2 presents the one- and two-year post-downgrade cumulative returns of fallen angels (over peers), as well as the two-year information ratio for roughly equal four time periods since 1990.

The results in Figure 2 reflect a large degree of consistency across periods, with fallen angels outperforming peers by about 5.5% to 9.5% during the two years after downgrade. Furthermore, the similarity in information ratios implies that not only the cumulative performance but also the month-to-month variation in returns during the 24 months was fairly stable over time. Even the one-year cumulative return between 1995 and 1999, which was a clear exception, was essentially on par with that of other high yield bonds.

Figure 2: Post Downgrade Relative Performance of Fallen Angels by Period

Downgrade Year	Number of bonds	Cumulative Returns over Peers After Downgrade		Information Ratio
		1-Year	2-Year	over 2-Year Period
1990-1994	173	3.03	7.88	0.36
1995-1999	211	-0.52	5.46	0.42
2000-2005	771	4.16	8.77	0.50
2006-2011	372	7.06	9.25	0.49

Note: The table reports the cumulative returns in the first 12 and 24 months after the downgrade by period. Cumulative returns were calculated by first averaging the returns of fallen angels' bonds over peers each month after the downgrade and then cumulating the first 12 or 24 months. Information ratio is the ratio of relative returns of fallen angels averaged over the 24 month period after the downgrade divided by the volatility of the monthly time-series. Source: Barclays Capital

The results in Figure 2 indicate that the strong performance reversal pattern we documented for fallen angels after their downgrade was not driven by a single period, but was evident throughout the entire sample. This of course does not imply a lack of change

over time, as the results in Figure 2 would exhibit more variation had they been presented annually. In addition, as we illustrate in the next section, the degree of initial underperformance and subsequent reversal are affected by the aggregate supply of fallen angels, which is in turn correlated with overall market conditions.

Fallen Angels in the Euro Corporate Market

Many European investors have inquired as to whether European fallen angels exhibit price dynamics similar to those we have documented in the U.S. market. There are three possible reasons why our previous results may not extend to European fallen angels. First, in the U.S., the Barclays Capital Corporate Index is the most widely used benchmark against which investors manage their U.S. investment grade credit allocation. Barclays Capital's Euro Corporate Index, however, does not have such a dominant position. Hence, changes in its constituents may result in less forced selling and consequently have smaller pricing implications. Second, differences in regulation and the formulation of investment mandates in the Euro market may weaken the incentive to sell fallen angels at the time of downgrade (or shortly prior to it), which would reduce the magnitude of forced selling. Third, the U.S. high yield market is 4-5 times larger than the corresponding European market. This results not only in a lower absolute supply of European fallen angels, but also in a larger variation in their share of the aggregate high yield market. For example, Figure 3 shows that in 2002, 2005 and 2009, fallen angels' share of the European high yield market was 77.7%, 30.7% and 32.5%, respectively, while in the U.S., the corresponding figures were never higher than 15.5% (with the exception of 2002).

Figure 3: Issuer Population and Market Value of Fallen Angels by Year in the Euro Market

Downgrade Year	Euro Fallen Angels			Market Value of U.S. Fallen Angels as % of U.S. HY Index
	Number of Issuers	Market Value (€mn)	Market Value as % of Euro HY Index	
2000	3	787	4.2%	4.7%
2001	4	1,926	8.8%	13.7%
2002	16	20,006	77.7%	28.8%
2003	8	8,764	15.9%	7.9%
2004	4	3,027	4.6%	5.8%
2005	15	22,996	30.7%	15.4%
2006	5	5,529	6.7%	3.0%
2007	3	1,838	2.2%	4.7%
2008	11	7,146	13.0%	6.6%
2009	35	25,054	32.5%	8.1%
2010	16	11,462	8.5%	1.9%
2011	21	27,833	17.8%	1.4%

Note: For fallen angels' issuers, market value is measured as of the beginning of the downgrade month. For the indices, market values are based on averaging monthly figures in each year. Source: Barclays Capital

Figure 4 repeats the 'event study' analysis in Ben Dor and Xu (2010) for the sample of European fallen angels downgraded between 2000 and 2011. The table reports the average monthly relative returns (and associated *t*-statistics) by quarter relative to the downgrade month, as well as the cumulative relative returns as of the end of each quarter.[3] These statistics are presented for the entire sample, and separately for two states of the market based on the share fallen angels represented out of the aggregate high yield market. 'High

[3] Formally, the relative cumulative return of downgraded issuers from the start of the analysis window until month *T* is defined as $R_j^T = \prod_{t=-12}^{T}\left(1+\sum_i w_{i,t}(R_{i,t}-R_{i,t}^p)\right)-1$, where $w_{i,t}$, $R_{i,t}$ are the relative weight and total return of issuer *i* in month *t*, respectively, and $R_{i,t}^p$ is the contemporaneous weighted return of all the peer groups corresponding to issuer *i*'s outstanding bonds.

Supply Years' correspond to years where that percentage was above 30% (2002, 2005, and 2009) while the remaining years are termed 'Low Supply Years'.

Consistent with the previous results for the U.S., the monthly relative returns in the downgrade month and during the previous three quarters were all negative and highly significant for European issuers, resulting in a cumulative underperformance of 18.54% over the entire sample. Price dynamics then reversed course and the downgraded issuers consistently outperformed their peers in the following two years. Although the individual monthly relative returns (over peers) are not statistically significant (given the relatively small sample size), they accumulate to a total outperformance of 6.93%. This figure is remarkably similar to the 6.63% outperformance documented by Ben Dor and Xu (2010) for U.S. issuers, despite the much longer period used in their sample. The results are also consistent with Bolognesi, Ferro and Zuccheri (2011) who document an abnormal return of -5% during the event month and 0.81% in the following quarter (compared with -5.16% and 0.78%, respectively, in Figure 4) despite the use of a different index, data frequency and period.[4]

In contrast, comparing the performance dynamics in 'High Supply' and 'Low Supply' years reveals striking differences both before and after downgrade. Issuers downgraded in 'High Supply' years experienced larger initial losses (-22.61% versus –14.44% in 'Low Supply' years), but then posted much stronger recoveries (cumulative outperformance from the downgrade of 10.24% and 2.48%, respectively). The difference between 'High Supply' and 'Low Supply' years is fully consistent with the effects of forced selling when market demand is limited.[5] The lack of prospective buyers facilitate a temporary price distortion, with prices initially dropping below their fundamental values, and then returning to equilibrium levels over time as the selling imbalance abates.

Figure 4: Quarterly Average and Cumulative Relative Returns of Euro Issuers Downgraded to HY

Quarter Relative to Downgrade Month	Number of Obs.	Avg. Relative Monthly Ret.(bp)	t - stat	Relative Cum. Ret.	Number of Obs.	Avg. Relative Monthly Ret.(bp)	t - stat	Relative Cum. Ret.	Number of Obs.	Avg. Relative Monthly Ret.(bp)	t - stat	Relative Cum. Ret.
	Full Sample				Low Supply Years				High Supply Years			
-4	289	-18	-0.52	-0.55%	181	14	0.26	0.43%	108	-68	-1.49	-1.62%
-3	310	-77	-2.07*	-2.81%	193	-37	-1.03	-0.73%	117	-160	-1.70	-5.06%
-2	357	-146	-2.63**	-7.02%	202	-72	-2.09	-2.84%	155	-274	-1.98*	-11.28%
-1	361	-259	-3.88**	-14.12%	207	-191	-2.86**	-8.29%	154	-350	-2.68**	-19.72%
Downgrade Month	123	-516	-4.85**	-18.54%	71	-671	-5.12**	-14.44%	52	-264	-2.10*	-22.61%
1	337	78	0.83	-16.62%	188	-12	-0.10	-14.61%	149	257	1.06	-19.02%
2	305	-10	-0.17	-16.81%	174	-24	-0.26	-14.90%	131	72	-0.01	-19.04%
3	302	43	0.84	-15.73%	159	69	0.66	-13.15%	143	29	0.61	-18.33%
4	301	24	0.57	-15.12%	143	-33	-0.40	-14.02%	158	55	1.09	-17.09%
5	287	22	0.56	-14.56%	134	-19	-0.22	-14.46%	153	23	1.08	-16.11%
6	265	14	0.41	-14.17%	130	20	0.26	-13.91%	135	28	0.39	-15.80%
7	257	5	0.13	-14.03%	120	-24	-0.30	-14.55%	137	-4	0.43	-15.31%
8	231	44	0.62	-12.90%	87	86	1.63	-12.32%	142	33	0.24	-14.68%

Note: The table reports the performance of Euro issuers by quarter relative to their downgrade month for the entire sample (2000 – 2011) and separately for high supply years (2002, 2005, and 2009) and low supply years (2000, 2001, 2003, 2004, 2006-2008, 2010, 2011). Average monthly relative returns were computed by pooling returns over peers (relative returns) across all issuers and months in each quarter weighted by market value. *T*-statistics were adjusted for serial and cross sectional correlation. *, ** denote significant at the 5% and 1% levels, respectively. Cumulative relative returns were calculated by first averaging issuers' relative returns each month and then compounding them, starting 12 months before the downgrade. Cumulative relative returns are reported as of the end of each quarter.
Source: Barclays Capital

[4] Bolognesi et al. (2011) use daily data from the Merrill Lynch Investment grade EMU Non Financial Corporate Index from January 2000 to December 2009.

[5] Notice that the proportion fallen angels constitute of the Euro high yield market is affected by their aggregate supply, as well as by the absolute size of the market. For example, despite the similar market value of fallen angels in 2002 and 2005, their share was 77.7% and 30.7%, respectively.

Mean Reversion and Default Rate

After analyzing the stability of fallen angels' price dynamics across time and markets, we turn to the performance of the '3-Months Reversal' strategy. To what extent did its strong performance (relative to high yield peers) emanate from the existence of a mean reversion pattern in the high yield market as opposed to characteristics unique to fallen angels?[6] Pospisil and Zhang (2010), for example, find evidence of reversal effects in high yield bonds during periods of decreasing credit spreads.[7]

At first, it may seem that one need only compare the performance of the '3-Month Reversal' to that of the 'Buy All' strategy, which does not condition buy/sell decisions on relative pricing information. Over the 20 years of the original study, the '3-Months Reversal' strategy earned an average relative return of 0.78%/month with an information ratio of 1.03 versus 0.31%/month and an information ratio of 0.64 for the 'Buy All' strategy (Figure 1). However, the two strategies differ in terms of the inclusion month, which may affect performance considerably. In fact, the formulation of the '3-Months Reversal' strategy was formulated to capitalize on Ben Dor and Xu's (2010) findings that the optimal time to purchase fallen angels was, on average, three months after their exclusion from the Barclays Capital Corporate Index. They showed, for example, that if a '1-Month Reversal' strategy were implemented by buying fallen angels at the end of the first month after their downgrade, the relative performance and information ratio would fall to 0.64%/month and 0.87, respectively.

To properly quantify the contribution of mean reversion to the performance of the '3-Month Reversal' strategy, we apply the same strategy to the universe of high yield bonds, which are not fallen angels.[8] The alternative 'Mean-Reversion' portfolio is rebalanced monthly and purchases any high yield bond trading at relative spreads to peers of at least 40bp. As with fallen angels, these bonds are sold from the portfolio once their relative spreads become negative or if 21 months have passed since the date they were acquired.[9]

Figure 5 displays various performance statistics for several variants of the Mean-Reversion portfolio, as well as for the Barclays Capital High Yield Index and the 3-Month Reversal strategy. Comparing the Sharpe Ratio of the equally-weighted and market value-weighted Mean Reversion portfolios to that of the High Yield Index suggests the existence of a mild reversal pattern concentrated among smaller issuers. However, even the equally weighted mean-reversion portfolio did not earn a risk-adjusted return that was substantially higher than that of the High Yield Index (0.72 versus 0.66, respectively, over the entire sample period). Furthermore, once the monthly returns of the equally weighted mean-reversion portfolio are adjusted to reflect the un-invested cash position of the 3-Month Reversal strategy (termed 'Mean Reversion Port. (EW) with Matching Cash allocation'), the performance difference is striking.[10] Not only is the performance of the 3-Month Reversal strategy superior in both sub-periods (0.92% versus 0.44% and 1.86% versus 1.11% in the first and second halves of the sample, respectively), but its tail risk properties, such as the worst 1- and 3-month returns, are consistently better than the Mean Reversion Port (EW)

[6] Recall that the "3-Month Reversal" portfolio purchased only bonds that were trading at spreads higher than their high yield peers by at least 40bp which were then sold once their relative spreads declined to zero.

[7] Pospisil and Zhang (2010) find that a strategy which buys past high yield winners, provides higher cumulative returns than a strategy of buying past losers over 1998-2009, and is related to the behavior of credit spreads during a credit cycle. Specifically, the momentum effect is strongest during periods of widening credit spreads and dominates the reversal effect that can be observed during periods of decreasing credit spreads.

[8] Specifically, the universe is comprised of all bonds that were included in the Barclays Capital High Yield Index and did not have an investment-grade rating in the previous 24 months (see the construction of peer groups in the 'Data and Methodology' section in Ben Dor and Xu (2010) for more details).

[9] The 21 months correspond to the period between the timing of fallen angels purchase in the '3-Month Reversal' strategy and the end of the analysis window (24 months after the downgrade).

[10] Recall that to mitigate issuer concentration risk, Ben Dor and Xu (2010) impose a 10% position limit per issuer. Thus, the 3-Month Reversal would have an allocation to cash any time the number of issuers in the portfolio is less than 10.

with Matching Cash allocation, even though the latter has a more diversified population of bonds. These results confirm that the performance of the 3-Month Reversal strategy does not simply reflect a general mean reversion pattern in high yield bonds but rather price dynamics specific to fallen angels.

Figure 5: Performance of Mean Reversion Portfolios Using High Yield Bonds vs 3-Month Reversal Strategy

	High Yield Index	Mean Reversion Port. (VW)	Mean Reversion Port. (EW)	Mean Reversion Port. (EW) with Matching Cash allocation	3-Month Reversal Portfolio
January 1991-December 2011					
Avg. return (Monthly)	0.82%	0.88%	1.14%	0.80%	1.41%
Std. return (Monthly)	2.66%	3.73%	3.93%	3.48%	3.71%
Sharpe Ratio (Ann.)	0.66	0.53	0.72	0.48	1.02
Worst month	-15.91%	-16.42%	-19.35%	-19.35%	-10.76%
Fifth percentile of return distribution	-3.23%	-5.14%	-4.60%	-3.77%	-3.47%
Worst three months	-29.82%	-34.62%	-34.96%	-34.96%	-26.01%
January 1991-December 2000					
Avg. return (Monthly)	0.90%	0.99%	1.15%	0.44%	0.92%
Std. return (Monthly)	1.83%	2.64%	2.78%	1.39%	1.90%
Sharpe Ratio (Ann.)	0.90	0.73	0.90	0.03	0.89
Worst month	-5.52%	-8.89%	-8.87%	-6.48%	-5.70%
Fifth percentile of return distribution	-1.52%	-3.17%	-3.36%	-1.83%	-1.03%
Worst three months	-9.41%	-18.20%	-14.86%	-14.69%	-5.76%
January 2001-December 2011					
Avg. return (Monthly)	0.74%	0.77%	1.12%	1.11%	1.86%
Std. return (Monthly)	3.25%	4.51%	4.76%	4.61%	4.76%
Sharpe Ratio (Ann.)	0.57	0.44	0.67	0.69	1.20
Worst month	-15.91%	-16.42%	-19.35%	-19.35%	-10.76%
Fifth percentile of return distribution	-3.78%	-6.19%	-5.39%	-5.38%	-4.79%
Worst three months	-29.82%	-34.62%	-34.96%	-34.96%	-26.01%

Note: The mean-reversion portfolio is rebalanced monthly and purchases any high yield bond trading at relative spreads to peers of at least 40bp. Bonds are sold from the portfolio once their relative spreads become negative or if 21 months have passed since the date they were acquired. The portfolio returns are weighted either equally or by market weights. The 'Mean Reversion Port. (EW) with Matching Cash allocation' includes a monthly cash position equal to that in the '3-Month Reversal' Portfolio. Source: Barclays Capital

Default Rates

Some investors expressed concerns that fallen angels are susceptible to higher default rates. Although the performance figures reported for all strategies reflect the effect of bonds that defaulted while in the portfolio, we compare the default rates among fallen angels and other high yield issuers, directly. There are at least two reasons why such an analysis is important. First, since investing in defaulted bonds requires specialized knowledge, we assumed that most investors would liquidate their positions at prices corresponding to the month-end following the default month. In some cases, however, these prices may not be transactable or investors may be unwilling to sell at that time. Second, beyond the direct effect on prices, default events may bring additional reputational and legal costs for some investors, which our performance figures do not capture.

Figure 6 presents the annual number and amount outstanding of defaulted fallen angels, as well as other issuers that were part of the Barclays Capital High Yield Index.[11] Over the 22-year period since 1990, 88 issuers classified as fallen angels, defaulted out of an overall population of 614 issuers that were fallen angels at some point with most defaults occurring during 2001-03 and the 2008-09 financial crisis. These figures translate into a default rate of 15%, compared with almost twice that rate (24%) among other high yield issuers. Not surprisingly, in terms of amount outstanding, the difference in default rates between the two populations was much smaller (12% and 16%, respectively), reflecting the larger average size of debt rated investment grade at issuance (as are fallen angels), compared with non-investment grade debt. In 2002, the amount outstanding that defaulted peaked at $38bn, reflecting the WorldCom bankruptcy in July 2002.[12] Overall, the table indicates that the default rates of fallen angels are certainly not higher and generally even lower compared to other high yield bonds.

Figure 6: Annual Default Rates in the Barclays' Capital High Yield Index by Issuer Type

	Number of Defaulted Issuers		Amount Outstanding of Defaulted Issuers($mn)	
Year	Fallen Angels	Other High Yield	Fallen Angels	Other High Yield
1990	0	18	0	6,767
1991	2	41	1,150	10,963
1992	1	41	100	10,224
1993	0	19	0	3,380
1994	0	4	0	368
1995	0	18	0	3,714
1996	0	19	0	3,652
1997	1	6	279	1,369
1998	0	17	0	2,791
1999	1	61	125	14,937
2000	2	110	1,500	26,692
2001	14	143	10,724	44,589
2002	20	108	37,927	60,231
2003	14	80	13,504	21,603
2004	1	34	200	8,053
2005	6	27	11,487	6,741
2006	1	14	1,740	4,620
2007	0	11	0	2,729
2008	2	43	2,404	17,445
2009	22	90	35,920	53,813
2010	1	19	800	6,464
2011	6	20	1,576	12,525
Total	94	943	119,438	323,668
Issuer population in the High Yield Index	616	3,870	980,401	2,053,583
Aggregate Default Rate	15%	24%	12%	16%

Note: 'Other High Yield' refers to any issuer that was part of the high yield index at some point and was never downgraded from investment grade status. The calculation of default rates disregards bonds vintage years.
Source: Barclays Capital

[11] Other high yield refers to any issuer that was part of the high yield index at some point and was never downgraded from investment grade status.

[12] Notice that issuers that proceeded to default directly from investment grade status such as Lehman Brothers in 2008 are not included in the analysis in Figure 6.

Capacity and Cost of Implementing a Fallen Angels Strategy

Investors interested in committing capital to exploit the price dynamics of fallen angels face two important considerations. First, what is the capacity of a strategy dedicated to fallen angels? More specifically, what is the relation between the amount of capital allocated to the strategy and its performance? Second, what is the impact of transaction costs? Would the strategy become unattractive once transactions costs were incorporated in performance statistics? In this section, we study these implementation issues in detail.

Investment Capacity

Ben Dor and Xu (2010) did not address the scalability of their rule-based strategies. Their return figures did not account for possible degradation in performance as a result of possible price impacts once the strategies were employed in practice. Their analysis, thus, implicitly assumed that the capital invested in any of the strategies would be sufficiently small relative to the aggregate supply of fallen angels to not affect their pricing.

A direct analysis of scalability requires a model of price impact, which is beyond the scope of this paper. Instead, we assume that the maximum position size of any issuer in the portfolio is capped at a certain percentage of its total market value to minimize any price impact. Given this constraint, we vary the size of the portfolio and analyze the effect on performance. Specifically, we assume that the dollar holding in any issuer is no more than 5% of its market value, while the sizes of the fallen angels portfolios vary from $125mn to $2bn.[13] For example, suppose the portfolio size is $500mn and there are 12 eligible issuers. If there are no capacity constraints, each issuer would have a weight of 8.33% or $41.67mn in dollar terms. With a maximum position size of 5%, the constraint will be binding for any issuer with a market value of less than $833.33mn. In the case of an issuer with a market value of $500M, the actual position size would be $25mn (equivalent to 5% of its total market capitalization) and the portfolio will have a cash position of 3.33%.

Notice that the weight of any issuer in the portfolio is determined by the ratio of the cap and portfolio size. Hence, a $500mn portfolio with a market value cap of 5% would have the same return profile as a $250mn portfolio with a cap of 2.5%. This is easily seen from the formula for issuer's *i* weight:

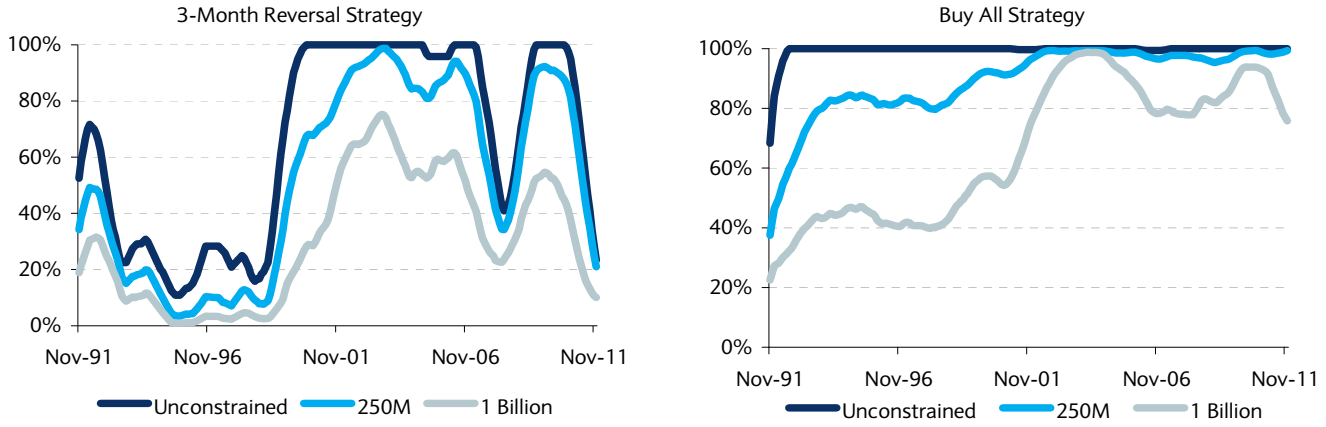
$$(1) \qquad W_i = \min\left(\frac{1}{N}, 10\%, \frac{Cap \times MV_i}{Port.size}\right)$$

where the first term represents the base case of equal allocation to each issuer, the second term is the limit on issuer concentration introduced in Ben Dor and Xu (2010), and the last term is the constraint on the size of the dollar position in issuer *i*.

For relatively small portfolios, the capacity constraint may not be binding for any issuer and the portfolios will be identical to the ones in Ben Dor and Xu (2010). In contrast, for sufficiently large portfolios, the capacity constraint would apply to all issuers, and the non-cash component of the portfolio will be market value weighed. More generally, there are two deviations from the compositions of our original portfolios as their size increases. First, the non-invested component (ie, allocation to cash) becomes larger as more issuers reach the capacity limit. Second, the portfolio tilts from being equal weighted toward being market-value weighted.

[13] In Ben Dor and Xu (2010), the strategies were implemented using individual bonds with only one bond per issuer being included in a portfolio. Since this will underestimate capacity, we use issuer level data when all underlying bonds were aggregated by market value.

Figure 7: Proportion Invested in Fallen Angels as a Function of Portfolio Size



Source. Barclays Capital

Figure 7 shows the average (over a rolling 12-month window) non-cash percentage in the Buy All and 3-Month Reversal portfolios for different levels of capital investment.[14] As portfolio size increases, the allocation to fallen angels generally declines as more issuers meet the capacity limit; the magnitude of the effect, however, varies with the supply of fallen angels and across strategies. Not surprisingly, the impact is typically more pronounced for the "3-Month Reversal" portfolio since the eligible investable universe is considerably smaller. For example, for a portfolio size of $1bn, only 53% of the "3-Month Reversal" strategy would have been invested in fallen angels in August 2004, compared with 98% in the case of the "Buy All" strategy.

Figure 8 presents various performance statistics for the Buy All and 3-Month Reversal strategies across a range of portfolio sizes. Cash allocation (as a percentage of the strategy committed capital) increases with size, leading to a decrease in average return, as well as in volatility. As expected, the effect is more pronounced for the "3-Month Reversal" strategy. For example, the average monthly return of the "3-Month Reversal" strategy drops by 74bp as size increases from $125mn to $2bn, while the drop for the "Buy All" strategy is only about 27bp. In terms of Sharpe Ratios, the decline is very modest for the Buy All strategy. Even in the case of the "3-Month Reversal" strategy, the Sharpe Ratio decreases to 0.95 (from 1.14) for a portfolio size of $2bn, well above that of the High Yield Index (0.65).

Figure 8: Performance of Buy All and 3-Month Reversal Strategies by Portfolio Size

	$125mn	$250mn	$500mn	$1bn	$2bn
Buy All (January 1991 – December 2011)					
Avg. return (Monthly)	1.04%	1.01%	0.96%	0.88%	0.77%
Std. return (Monthly)	2.71%	2.64%	2.52%	2.22%	1.75%
Sharpe Ratio (Ann.)	0.92	0.90	0.88	0.88	0.88
Worst month	-12.54%	-12.38%	-12.15%	-10.96%	-7.99%
Fifth percentile of return distribution	-2.62%	-2.10%	-2.11%	-1.70%	-1.20%
Worst three months	-25.20%	-25.06%	-24.95%	-23.02%	-18.28%
3-Month Reversal (January 1991 – December 2011)					
Avg. return (Monthly)	1.37%	1.24%	1.03%	0.81%	0.63%
Std. return (Monthly)	3.17%	2.85%	2.27%	1.68%	1.13%
Sharpe Ratio (Ann.)	1.14	1.12	1.08	1.02	0.95
Worst month	-7.57%	-7.03%	-5.86%	-4.45%	-2.83%
Fifth percentile of return distribution	-2.63%	-2.47%	-1.89%	-1.35%	-0.79%
Worst three months	-17.63%	-16.81%	-14.14%	-10.80%	-7.09%

Note: Source: Barclays Capital

[14] Portfolio size is assumed to remain constant over time in order to neutralize the impact of monthly performance and focus on the issue of capacity.

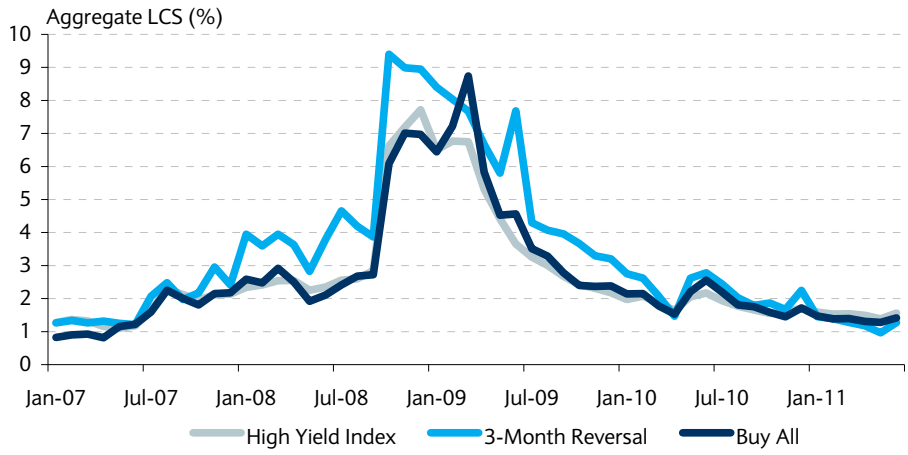
Overall, the results in Figure 8 suggest that although capacity considerations do affect the performance of the fallen angels' portfolios, the degradation is modest; both the Buy All and 3-Month Reversal strategies outperform the High Yield Index over time, irrespective of the amount of capital invested.

Liquidity and Transaction Costs

Evaluating the performance of any strategy requires a consideration of its transactions costs. This is especially important when investing in fallen angels since the forced selling that eventually leads to performance reversal also results in lower liquidity (relative to other high yield bonds) shortly after the downgrade. Therefore, we explicitly incorporate transaction costs into our performance estimates using a measure of bond liquidity known as LCS (Liquidity Cost Score) introduced by Dastidar and Phelps (2009). It represents the cost of an institutional size round-trip transaction in a bond as a percentage of its market price based on traders' quotes and is available at the cusip level since January 2007.

Figure 9 plots the average LCS of our rule-based strategies along with that of the High Yield index. As expected, the LCS of the fallen angel portfolios closely tracked that of the High Yield Index and all reached record highs during the height of the financial crisis. Although the LCS of the "Buy All" strategy was very similar to the High Yield Index with an average difference of only 3bp, the transaction costs associated with the "3-Month Reversal" strategy were typically higher. This reflects the fact that bonds eligible for the "3-Month Reversal" strategy generally had higher spreads, and as a result, higher LCS values.[15]

Figure 9: LCS Values for Fallen Angel Strategies and the High Yield Index



Source: Barclays Capital

The returns calculated by Ben Dor and Xu (2010) for the Buy All and 3-Month Reversal strategies were based on prices at the bid. To capture the effect of transaction costs on performance we mark the price of each bond when it was acquired to reflect the ask level based on its LCS value at that time.[16] Figure 10 compares the performance of the two strategies before and after transaction costs. Not surprisingly, the impact on the "3-Month

[15] Wider spreads are typically associated with higher LCS. Recall that only bonds trading at spreads higher than their high yield peers by at least 40bp are eligible for the "3-Month Reversal" portfolio, while the Buy All portfolio purchases al fallen angel bonds.

[16] Specifically, the net portfolio return is defined as $\sum_i (w_{i,t} \times R_{i,t}) - LCS_{j,t-1} \times \max(w_{i,t} - w_{i,t-1}, 0)$

where $w_{i,t}$, $R_{i,t}$ are the relative weight and total return of issuer *i* in month *t*, respectively, and $LCS_{i,t-1}$ is the bid-ask spread of bond i as of the end of the previous month (t-1).

Reversal" strategy is much larger than on the "Buy All" strategy (a decline of 59bp/month compared with 37bp/month, respectively). This reflects not only the higher LCS and turnover of the "3-Month Reversal" strategy, but also the strong positive correlation between turnover and LCS. In other words, the "3-Month Reversal" portfolio experiences larger turnover at times when the LCS values are higher.

The results in Figure 10 suggest that even net of transaction costs, both strategies provide attractive returns, with Sharpe Ratios around 0.65 versus 0.43 for the High Yield Index. It is also important to note that our LCS data most likely overstates the true cost incurred by investors for three reasons. First, it is based only on quotes from a single broker-dealer and may not represent the inside market. Second, the period for which LCS data is available coincided with a severe liquidity crisis. Hence, the long-term trading costs of fallen angels may be lower in general. Third, the portfolios' construction method, which assumes monthly rebalancing (based on equal-weighting all bonds), results in excessive turnover and is unlikely to be used.

Figure 10: Effect of Transaction Costs on Performance of Fallen Angels Strategies

	Buy All		3-Month Reversal		HY Index	
February 2007-December 2011	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**
Avg. return (Monthly)	1.28%	0.91%	1.80%	1.21%	0.69%	0.66%
Std. return (Monthly)	4.53%	4.29%	5.79%	5.49%	4.14%	4.13%
Sharpe Ratio (Ann.)	0.86	0.61	0.98	0.66	0.45	0.43
Average Turnover	18.0%		23.6%			
Average LCS	2.67%		3.30%		2.64%	
Correlation btw. Turnover and HY LCS	0.13		0.61			

Note: Net performance figures are based on using LCS values to reflect ask prices for bonds when they are purchased into the portfolio. See also footnote 15. The estimates of transaction costs for the High Yield Index are based on Dastidar and Phelps (2011). Source: Barclays Capital

Trading the Bond-CDS Basis of Fallen Angels

Many investors are interested in exploiting the temporary dislocation in the pricing of fallen angels without taking on both the systematic and idiosyncratic credit risk associated with holding a limited number of high yield bonds (eg, holding the Buy All portfolio and, to a larger extent, the 3-Month Reversal portfolio). One possible approach is trading the bond-CDS basis.

The forced selling of fallen angels' bonds is not accompanied by a similar dynamic in the credit default swaps referencing these issuers. As a result, CDS spreads generally widen after the downgrade but to a lesser extent than those of bonds, and the basis exhibits mean reversion, widening initially and then gradually converging to its long-term equilibrium level. In this section, we investigate in detail a rule-based strategy designed to benefit from the expected mean reversion in the bond-CDS basis of fallen angels.

Sample Construction and Methodology

To analyze the properties of a bond-CDS basis investment strategy, we use a subset of the sample in Ben Dor and Xu (2010), which consists only of issuers downgraded to high yield between 2004 and 2010 and referenced by actively traded CDS contracts. Issuers downgraded as a result of a corporate event (ie, the reference entity was acquired by or merged into a new entity) were excluded because of the change in the corresponding CDS contract.

Following Ben Dor and Xu (2010), for each CDS we compile a time series of monthly spread and DV01 data over a 3-year window starting 12 months prior to the downgrade month. Our main data source is Markit, but quotes from Barclays Capital's traders are used as a secondary source whenever data from Markit is unavailable or stale. We clean out spreads once they are unchanged for over three months. CDS for which we obtain less than one year of data in the analysis window or less than six months during the first year following the downgrade were excluded.

Figure 11 reports the number of issuers and the aggregate market value of their bonds (as of the beginning of the downgrade month) in our matched bond-CDS sample, as well as for the dataset used by Ben Dor and Xu (2010). The final sample consists of 101matched bond-CDS pairs, which represent annually between 64% and 94% of the issuers included in the original study and 66% in terms of market value, on average.[17]

Figure 11: Annual Population and Market Value of Matched CDS-Bond Sample

	Sample in Ben Dor and Xu (2010)		Matched Cash-CDS Sample		Ratio of Matched Cash-CDS Sample to Ben Dor and Xu (2010)	
Year	Number of Issuers	Total Market Value ($mn)	Number of Issuers	Total Market Value ($mn)	Number of Issuers	Total Market Value
2004	20	33,207	14	25,428	70%	77%
2005	17	93,211	13	59,597	76%	64%
2006	16	18,329	15	15,702	94%	86%
2007	20	30,767	13	17,854	65%	58%
2008	25	36,257	16	28,866	64%	80%
2009	39	46,797	27	23,635	69%	51%
2010	4	2,517	3	1,655	75%	66%
Total	141	261,085	101	172,737	73%	69%

Note: Unsecured bonds trading under the same CDS were aggregated by market value as of the beginning of the downgrade month. Source: Markit, Barclays Capital

Figure 12 presents the average and median spreads of bonds and CDS in our sample by year, measured at the end of the downgrade month. Until 2007, median CDS spreads were similar to or slightly higher than those of bonds but the financial crisis that started that year resulted in a much larger widening of cash spreads relative to CDS. Average and median spreads were generally similar, with 2005 and 2008 being notable exceptions. The higher average spread (relative to the median) in 2005 was mostly driven by downgrades in the airline industry, while in 2008 it reflected additional downgrades in that sector, as well as the downgrade and eventual default of Ambac Financial Group. More generally, spreads around downgrade events may widen to levels that are not tradable and mostly reflect the illiquidity of the CDS or security. To limit the effect of these "theoretical" quotes, we cap spreads at the 95th percentile (20%). Note also that spreads in our sample were largely below those of the High Yield index (with the exception of 2009), since most fallen angels were downgraded to the highest speculative-grade rating.[18]

[17] All bonds referenced by the same CDS contract were aggregated monthly by market value.
[18] The fact that spreads of fallen angels in our sample are lower than that of the High Yield Index is not inconsistent with the evidence in Ben and Xu (2010), since they report spreads relative to peers matched by credit quality (as well as by industry and maturity).

Figure 12: Spreads of Bonds and CDS at Downgrade Month by Year (bp)

	Bond Spreads		Barclays Capital	CDS Spreads		
Year	Median	Average	HY Index	Median	Average	CDX HY Index
2004	200	276	329	207	279	380*
2005	249	529	298	246	580	350*
2006	157	204	266	232	229	312
2007	202	270	311	207	250	366
2008	642	1045	899	535	1025	788
2009	1393	1468	991	706	866	950
2010	559	590	603	139	195	555

Note: Spreads are measured as of the end of the downgrade month and capped at the 95th percentile (20%). The CDX High Yield Index is the on-the-run CDX.NA.HY Spreads of the CDX.NA.HY for 2004-2005 are imputed based on the relation between the bases of the investment-grade and high yield markets in later years (defined using the spreads of CDX.NA.IG and the Corporate Index and the CDX.NA.HY and High Yield Index, respectively). The correlation between the two bases was 75% in the years 2006-2010. Values for the High Yield Index and the CDX HY are averages of month-end Libor-OAS spreads for that year. Source: Markit, Barclays Capital

We define the cash-CDS basis as the difference between the spread of a 5y CDS and the market value-weighted OAS (computed relative to the Libor curve) of all unsecured bonds issued by the underlying reference entity.[19] We examined two alternative specifications for the basis but both generated results that were qualitatively and quantitatively very similar.[20]

Since the purpose of the investment strategy we analyze is to exploit issuer-specific mean reversion, it is important to control for changes in the cash-CDS basis that are driven by systematic factors. For example, Desclée, Ng, Phelps, and Polbennikov (2009) showed that the sharp rise of the basis between the Corporate Index and CDX.NA.IG in 2007 and the subsequent reversal were driven to a large degree by the marked change in market liquidity conditions.[21] To isolate the idiosyncratic part of the cash-CDS basis, we define the market-adjusted basis for issuer *i* as:[22]

(2) Market-adjusted basis for issuer *i* = (5y CDS spread – market-value weighted OAS of bonds) – (On-the-run 5y CDX.NA.HY spread – High Yield Index OAS)

Figure 13 displays the distribution of the market-adjusted basis of fallen angels, measured at the end of the downgrade month, by year. Overall, the dynamics are similar to those of the broad market (Figure 12) – tight in the first years of the sample but increasingly negative in recent years. A notable exception was the positive average basis in 2008, driven by downgrades in the airlines sector (United Airlines and American Airlines), where debt was largely secured and bonds generally traded richer than the corresponding CDS. In 2009-10, the basis of fallen angels was significantly larger (in absolute terms) than that of the overall high yield market, suggesting that the impact of forced selling was significantly exacerbated during the liquidity crisis.

[19] We use contracts with the No Restructuring clause (XR) as per the current US market standard. We do, however, use the Modified Restructuring (MR) contract for names where it was significantly more prevalent.

[20] The first alternative specification used only the two bonds straddling the 5-year point such that their weighted maturity was equal to that of the CDS (when two such bonds were not available for an issuer on a specific month, the bond with maturity closest to 5 years was used instead). In the second specification, the bond trading at the widest spread each month was used instead of the market-weighted bond aggregate to better represent the effect of the cheapest-to-deliver option.

[21] For additional discussion on the determinants of the cash-CDS basis see Blanco, Brennan and Marsh (2005), McAdie, and O'Kane (2001), and Zhu (2004).

[22] We do not change the definition of the systematic component of the basis in the downgrade month following the migration from investment grade to high yield rating to avoid discontinuity.

Figure 13: Distribution of Market-Adjusted Cash-CDS Basis by Year

Year	Mean	P_{10}	P_{25}	Median	P_{75}	P_{90}
2004	-46	-106	-65	-52	-31	18
2005	-27	-98	-83	-60	26	103
2006	-24	-139	-62	-8	31	83
2007	-79	-106	-97	-88	-66	-42
2008	50	-218	-184	-89	328	443
2009	-544	-1,233	-903	-476	-186	24
2010	-353	-606	-606	-387	-66	-66

Note: The market-adjusted basis is measured as of the end of the downgrade month, and defined as: (5y CDS spread – market-value weighted OAS of issuer *i* bonds) – (On-the-run 5y CDX.NA.HY spread – High Yield Index OAS). Spread data is capped at the 95th percentile (20%). Source: Markit, Barclays Capital

Analysis of the Cash-CDS Basis

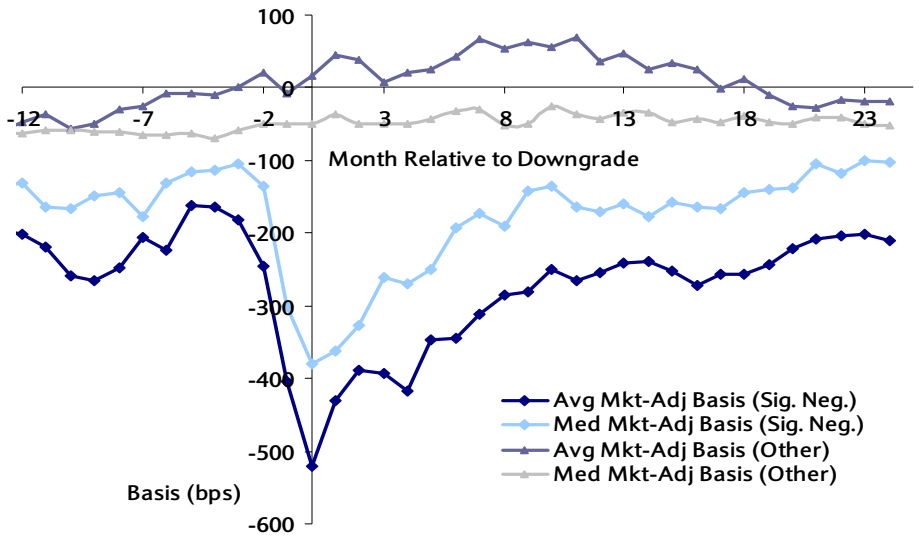
Ben Dor and Xu (2010) documented large variability in the performance of fallen angels after downgrade. While most outperformed peers and some even regained high grade status, others were downgraded further or even defaulted. To identify which fallen angels were more likely to exhibit price reversal, they consider spread relative to peers, among other criteria.

Figure 13 documents both time and cross-sectional variation in the sign and magnitude of the cash-CDS basis at the end of the downgrade month. In particular, it highlights the fact that for some issuers the basis was even positive at times. Figure 14, therefore, examines the relationship between the magnitude of the market-adjusted basis upon downgrade and its subsequent dynamics. The analysis is conducted for the top third of issuers in terms of market-adjusted basis (36 issuers with a basis larger than 120bp in absolute terms) and, separately, for the others.

Those with a significant negative basis indeed experienced strong mean reversion, as reflected in the median and the mean basis. The two rose sharply in absolute value in the six months prior to downgrade, from -130bp and -220bp, respectively, to -380bp and -520bp, respectively. In the following two years, they gradually mean-reverted back to their initial levels.[23] In contrast, the median basis of the second group (comprised of a roughly similar number of issuers with positive and with small negative basis) was relatively constant at low negative values, while its average hovered tightly around zero leading up to the downgrade and for most of the following year. It widened to 50bp approximately 12 months after the downgrade and then quickly declined to zero.

[23] Comparing the dynamics of the absolute and market adjusted basis confirms that controlling for the behavior of the broad market basis mostly represents a level shift and does not generate the reversal pattern we observe.

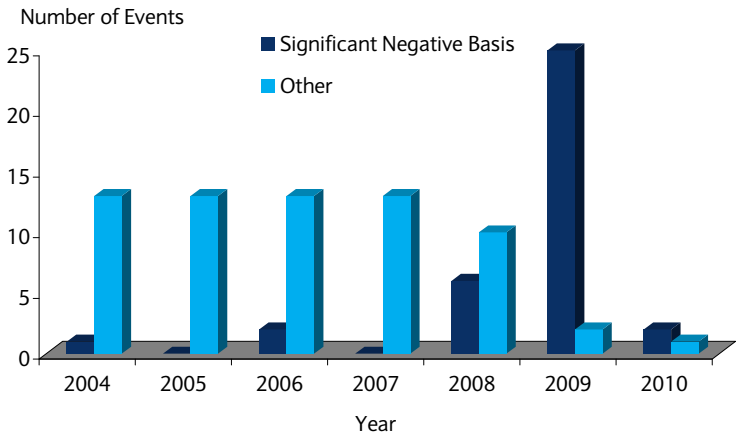
Figure 14: Dynamics of the Market-adjusted Cash-CDS Basis by Magnitude upon Downgrade



Note: The market adjusted basis is measured as of the end of the downgrade month, and defined as: (5y CDS spread – market-value weighted OAS of issuer *i* bonds) – (On-the-run 5y CDX.NA.HY spread – High Yield Index OAS). "Significant negative basis" includes 36 issuers with a negative market-adjusted basis larger in absolute value than 120bp. "Other" includes all remaining 65 issuers in the sample. Source: Markit, Barclays Capital

As Figure 13 suggests, the downgrades in the two subgroups of issuers were not distributed uniformly over the sample years. Issuers with a significant negative basis were largely downgraded in 2009, while issuers with a small negative basis or even a positive basis were mostly downgraded earlier, in 2004-07 (Figure 15). The results again suggest that the liquidity crisis exacerbated the effect of forced selling on bond prices, driving cash spreads of fallen angels to extremely wide levels relative to other years in our sample.

Figure 15: Sample Distribution by Basis upon Downgrade and Year



Note: "Significant negative basis" includes 36 issuers with a negative market-adjusted basis larger in absolute value than 120 bp. "Other" includes all remaining 65 issuers in the sample. Source: Markit, Barclays Capital

The concentration of downgrades with a significant negative basis in 2009 also meant that their industry representation was highly skewed toward financials (17 out of 36 issuers). Issuers included in the second group were distributed much more uniformly across Auto, Airlines & Rail, Technology, Media & Telecommunications and Retail industries (Figure 16). In particular, all issuers but one in the Airlines and Railroad industry had positive bases,

reflecting the fact that debt in these industries is largely secured and bonds typically trade rich relative to CDS. The Technology, Media and Telecommunications industries were heavily targeted by private equity firms in 2004-07; the leveraged buyout targets were often downgraded to speculative grade shortly after the corporate events.

Figure 16: Industry Distribution by Basis upon Downgrade

Industry	Significant Negative Basis	Other	Total
Total	36	65	101
Auto, Airlines & Rail	1	10	11
Financials & REITs	17	6	23
Gaming & Lodging	2	7	9
Healthcare	1	3	4
Industrials	0	2	2
Manufacturing	4	1	5
Media & Telecom	2	12	14
Metals & Mining	1	0	1
Oil & Gas	0	4	4
Paper	3	3	6
Retail	2	8	10
Technology	1	8	9
Utilities	2	1	3

Note: Industry classification is based on Barclays Capital Index conventions. "Significant negative basis" includes 36 issuers with a negative market-adjusted basis larger in absolute value than 120 bp. "Other" includes all remaining 65 issuers in the sample. Source: Markit, Barclays Capital

Exploiting the Dynamics of Fallen Angels' Cash-CDS Basis

To exploit the behaviour of fallen angels' cash-CDS basis, we examine the performance of a strategy that acquires fallen angel bonds and buys protection on their issuers in the CDS market. Unlike Ben Dor and Xu (2010), we do not form portfolios that are dynamically rebalanced, but, rather, aggregate all individual (issuer) trades over time. Hence, we do not address the issues, discussed earlier, relating to cash management and the variability of supply. We first analyze the performance of several strategies with incremental holding criteria and then examine in greater detail the risks associated with their implementation.

Strategy Formulation

The base case formulation is akin to the "Buy All" cash strategy and initiates a trade on the basis of all the issuers in our sample at the end of the downgrade month. Our long cash position consists of a market value-weighted aggregate of each issuer's outstanding bonds (to ensure results are not driven by bond selection), accompanied by a short position in the corresponding CDS. The position is maintained for 24 months, unless the issuer defaults or all of its outstanding bonds are called or mature before the end of the two-year period.

The second formulation, termed "Sell Tight", incorporates pricing data into the exclusion criteria. Specifically, instead of a uniform holding period of 24 months, a trade is unwound once the basis tightens to the market basis level, so that additional tightening is less likely (ie, the market-adjusted basis is zero). The next formulation ("Sell Tight-Buy Wide") focuses on the subset of issuers with a market-adjusted negative basis of at least 120bp (in absolute terms) that seem to offer the best prospect of mean-reversion(Figure 14). Once the position has been established, this criterion is no longer enforced.

In the final formulation, which is comparable to the "3-Month Reversal" portfolio, positions are initiated only three months after the downgrade month (in addition to the aforementioned inclusion and exclusion criteria). The timing is motivated by evidence in Ben

Dor and Xu (2010) showing that the price reversal process starts three months after the downgrade, on average. We term this strategy "Sell Tight - Buy Wide in Month 3". Figure 17 summarizes inclusion and exclusion criteria by strategy.

Figure 17: Cash-CDS Basis Investment Strategy Formulation

Strategy	Indicator	Buy All	Sell Tight	Sell Tight - Buy Wide	Sell Tight - Buy Wide in Month 3
Inclusion Criterion (if all apply)	Timing	Downgrade Month	Downgrade Month	Downgrade Month	Month 3
	Market-Adjusted Basis	N/A	N/A	<-120bp	<-120bp
Exclusion Criterion (if one applies)	Technical	Yes	Yes	Yes	Yes
	Market-Adjusted Basis	N/A	>0	>0	>0
	Timing	Month 24	Month 24	Month 24	Month 24

Note: Technical criteria are triggered if an issuer defaults or if its all of its outstanding bonds are called or mature.
Source: Barclays Capital

Performance Analysis

Figure 18 displays portfolio characteristics of the four strategies (Panel A), as well as performance statistics for the overall strategies over time (Panel B) and for individual pairs (Panel C).[24] It also reports net Sharpe Ratios based on estimates of average transaction costs per trade. The calculation of transaction costs assumes paying the *ask* and receiving the *bid* prices upon initiating and terminating the trade, respectively.[25] Figure 19 plots the strategies' cumulative gross returns.

The base case strategy ("Buy All") earned an average return of 0.5% a month with a volatility of 1.0%, resulting in a Sharpe Ratio of 1.05 and a net Sharpe Ratio of 0.26 (based on an average bid-ask estimate of 4.9%). The strategy generated fairly consistent returns, with a drawdown of only 1.8%, and 85% of the pairs earning positive total returns. Consistent with prior evidence, over 60% of the strategy's two-year cumulative performance was realized in the first eight months (Figure 19). Comparing the results in Panels B and C reveals that, as expected, average performance is similar, but volatility is much higher for individual pairs (8.3%). This volatility is largely driven by extreme positive realization (as suggested by the positive skewness), but there are also months of large negative performance, with the worst 5% of returns below -6.9%. A more detailed analysis reveals that most of the large negative returns were incurred by issuers with a positive basis (immediately following the event) or by issuers downgraded in 2009.

[24] The time series statistics in Panel B are based on time-aggregating returns of all pairs by market value (relative to the trade initiation date), while Panel C statistics reflect disaggregated data.

[25] Bid-ask spreads are based on LCS values. LCS for CDS are assumed to be 25% of LCS on the reference issuer underlying bonds. Missing individual LCS values were backfilled using the contemporaneous sample median value. Prior to 2007, when LCS data was not available, values were imputed based on the sample median LCS in 2007 adjusted by the ratio of spreads for the respective years.

Figure 18: Portfolio Composition and Performance Statistics for Bond-CDS Basis Strategies

	Buy All	Sell Tight	Sell Tight Buy Wide	Sell Tight Buy Wide Month 3
Panel A: Portfolio Composition				
Initial # Pairs	91	91	33	32
# of Early Sells (Before 2Yrs)	0	50	11	8
Avg. Holding Period (months)	24	14	18	17
Panel B: Performance Statistics over Time				
Average Return (monthly)	0.5%	0.8%	1.8%	1.4%
Return Volatility (monthly)	1.0%	1.1%	2.6%	1.4%
Avg./Vol. (ann.)	1.79	2.54	2.43	3.39
Sharpe Ratio (ann.)	1.05	2.04	2.38	3.30
Skewness	0.05	(0.06)	1.38	1.01
Maximum Drawdown	1.8%	1.6%	2.3%	0.5%
Net Sharp Ratio (ann.)	0.26	0.97	1.30	1.74
Trans. Costs	4.9%	4.9%	10.1%	5.7%
Panel C: Performance Statistics across Pairs				
% Pairs with Positive Return	85%	85%	93%	93%
Average Return (monthly)	0.8%	1.5%	2.5%	1.6%
Return Volatility (monthly)	8.1%	7.7%	10.3%	7.7%
Median Return	0.4%	0.6%	1.0%	0.9%
Skewness	1.21	5.96	4.54	6.01
Fifth Percentile of Ret. Distribution	-6.9%	-4.1%	-5.0%	-5.1%
Panel D: Performance Statistics with a Maximum Loss Constraint of 5% Per Trade				
Trades Closed due to Stop-Loss Trigger	30	16	7	6
Avg. Holding Period (months)	18	11	14	14
Sharpe Ratio (ann.)	0.74	1.45	2.31	2.68
Net Sharp Ratio (ann.)	0.05	0.63	1.23	1.53

Note: The table displays population and performance statistics for all four strategies presented. Initial number of pairs stands at 91, as returns could not be computed for 10 pairs, due to missing DV01 values. Panel B presents statistics for the overall value-weighted portfolio of pairs, held from the downgrade month or 3 months following it (varying by strategy) till the end of the analysis window (month 24). Panel C displays statistics across all pairs and months. Source: Markit, Barclays Capital

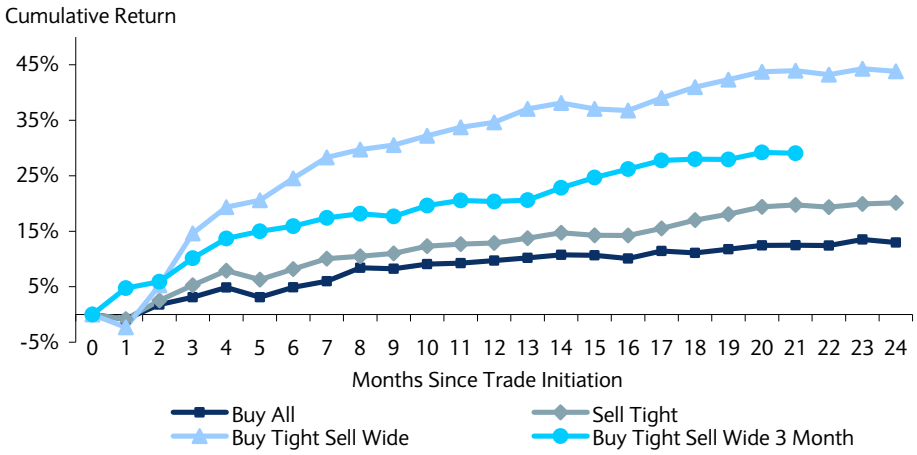
In the second formulation ("Sell Tight"), 50 trades were unwound before the end of the 24-month period. Most were liquidated shortly after their inception, "weeding out" the tight-basis pairs, with an overall holding period of 14 months, on average. In terms of performance, the inclusion of the relative basis condition led to higher average returns (0.8% versus 0.5% in the base case) with the same volatility and better drawdown (1.6%). The shorter holding period compared with the "Buy All" strategy (14 versus 24 months, respectively), resulted in an almost quadrupling of the net Sharpe Ratio to 0.97, although transaction costs were unchanged. Most of the performance pick-up versus the "Buy All" strategy was achieved in the second year, having sold off pairs that were unlikely to tighten further.

Limiting our universe to issuers with a wide negative basis at downgrade ("Sell Tight Buy Wide") resulted in a much smaller sample (33 issuers) with average performance more than doubling to 1.8% a month. Furthermore, more than half of the total cumulative return was realized in the first six months with 93% of the trades earning positive cumulative returns. However, as volatility rose sharply, as well (from 1.1% to 2.6%), the Sharpe Ratio increased only marginally to 2.38 from 2.04 for the "Sell Tight" strategy. In addition, part of the improvement reflects the lower financing rates in 2009, during which most of the trades

were initiated. Yet this strategy still delivered a better net Sharpe Ratio (1.3) despite transaction costs doubling compared with the "Buy All" and "Sell Tight" strategies.

The last column in Figure 18 displays the statistics for the "Sell Tight Buy Wide Month 3" strategy. The results indicate that initiating the trade three months after the downgrade led to a lower monthly return (1.4% versus 1.8%), which was more than offset by a commensurate drop in volatility (1.4% versus 2.6%). In addition, the cross-sectional tail risk properties improved as the strategy avoided continued widening of the basis in some pairs in the first three months. Overall, the strategy delivered the highest Sharpe Ratio (3.33), with the lowest drawdown (0.5%). As the liquidity of fallen angels generally improved in the first quarter after downgrade, transaction costs fell to 5.7%, resulting in a net Sharpe Ratio of 1.74.

Figure 19: Cumulative Gross Returns from Trade Initiation



Note: The graph displays the cumulative gross returns of the four cash-CDS basis strategies as a function of the time since trades were initiated. Source: Markit, Barclays Capital

Effects of Basis and Default Risk on Performance

The key risk associated with cash-CDS convergence strategies is widening of the basis due to idiosyncratic or systematic factors. The performance statistics in Panels B and C of Figure 18 capture the realizations of this risk only partially, as the formulation of our strategies assumes investors can maintain all holdings regardless of possible drawdowns in individual pairs. In practice, a stop-loss trigger is often applied. Hence, profit from trades where the basis ultimately tightened, but only after initially widening further, is reflected in Panels B and C, although it may not have been realized in practice. For example, the spreads on the bonds of LEN, PHM and MWV continued to widen following the downgrade and only later started to tighten, resulting in a positive cumulative return for the trades overall.

To address this issue, we incorporate into each of the strategies what we consider to be a fairly conservative stop-loss trigger, such that once the cumulative loss on a trade is larger than 5%, the position is liquidated immediately (irrespective of any other criteria listed in Figure 17). Panel D of Figure 18 reports the number of trades liquidated prematurely as a result of the trigger, the average holding period, and the updated gross and net Sharpe Ratios.

A comparison of the new results to those in Panels A and B indicates that sensitivity to basis risk is not uniform across the strategies. In the case of the 'Buy All' strategy, a third of the trades (30 out of 91) were liquidated and the net Sharpe Ratio dropped from 0.26 to 0.05. In contrast, for the 'Sell Tight Buy Wide' and 'Sell Tight Buy Wide Month 3' strategies, only

about 20% of the trades were affected, and the net Sharpe Ratios decreased very moderately (from 1.30 and 1.74 to 1.23 and 1.53, respectively). Therefore, it seems that if trades are initiated only when the basis is sufficiently large, the risk from further significant widening is limited, despite the fact that almost half of the trades in the two strategies realized negative returns at some point over the holding period.

While trading bond-CDS pairs of fallen angels assumes basis risk (although the results in Panel D of Figure 18 suggest that, historically, the risk was small and did not materially affect performance), investors are protected in the event of a default. Moreover, in cases where bonds were already trading at a deep discount when downgraded, being made whole upon default would have resulted in significant capital gains.

Our sample includes three firms that defaulted within the 24 month period after downgrade. To illustrate the difference in returns between buying the bond outright and using a CDS overlay, Figure 20 reports price and spread information for the bonds and CDS of Delphi – one of the three defaulted issuers. The figure also displays the returns for an investor trading the basis compared with just bonds by two trade initiation dates.[26]

Following the downgrade, an investor would have paid only slightly below par for the bond, resulting in a loss of 23.1% for a bond investor given the default price of 76.8. Factoring in the CDS premia and interest payments, based on a (weighted) coupon of 6.7%, would have generated a total loss of 17.5% for an investor in Delphi bonds, but a gain of 4.2% for a basis trader (the annual cost of protection on Delphi – 1.8%, was more than covered by the interest payments on the bond). Initiating the trade three months after the downgrade, when the bond was already trading lower, at 87.9, would have resulted in a smaller loss for a bond investor (8.7%) and a larger gain for a basis investor (14.8%). It should be noted, however, that, since the market adjusted basis was not sufficiently negative in either month (ie, larger than 120bp in absolute terms), a basis trade would not have been initiated by either the 'Sell Tight Buy Wide' or the 'Sell Tight Buy Wide Month 3' strategies.

Figure 20: Trade Statistics for Bond and Basis Investors in Delphi Automotive LLP

	Downgrade (Dec '04)	3 Months After Downgrade (Mar '05)	Default (Oct '05)
Bond / CDS Price Statistics			
Bond Price	99.9	87.9	76.8
Bond Spread	1.9%	4.5%	
CDS Premium	1.8%	5.0%	
Market-adjusted Basis (bp)	-50	10	
Returns to Bond Trade Initiated in the Respective Month			
Bond Price Return	-23.1%	-12.5%	
Total Return	-17.5%	-8.7%	
Returns to Basis Trade Initiated in the Respective Month			
Bond Price Return	0.1%	13.8%	
Total Return	4.2%	14.8%	

Note: The figure presents month-end price and basis statistics for Delphi Automotive, LLP bonds and CDS for various dates, as well as returns to bond-only and basis investors by month of trade initiation. For a definition of market-adjusted basis see Equation 2. Bond price returns assume the buyer of protection in the basis trade receives par upon default. Total return is computed as bond price return + (bond carry – CDS premium)*proportion of the year position was held. Source: Markit, Barclays Capital

[26] The bond statistics in Figure 20 are based on market-value weighting 4 Delphi' bonds (cusips 247126AB, 247126AC, 247126AD, 247126AE).

Summary

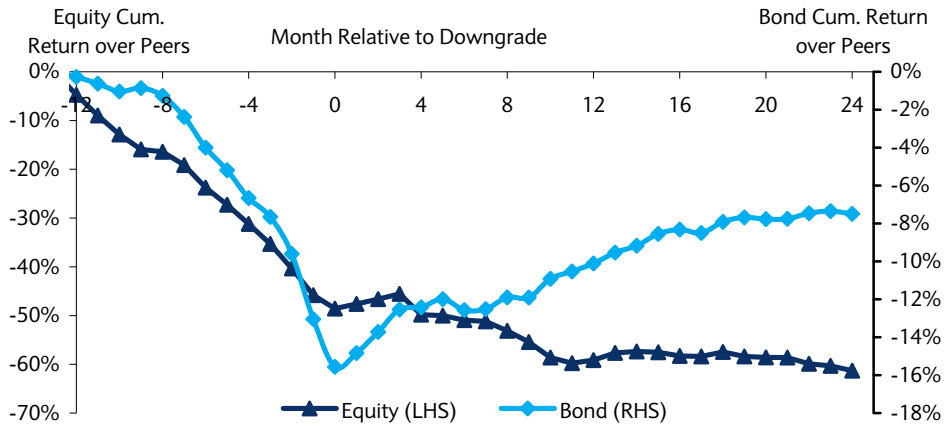
The results in this paper broadly reinforce the recommendations put forward in Ben Dor and Xu (2010). We provide evidence on the similarity of fallen angels' price dynamics in U.S. and European markets and on the relative stability over time of mean-reversion post downgrade. Thus, a policy of quickly liquidating fallen angels in the three months after the rating change, implemented by many investors who are benchmarked to the Barclays Capital Corporate Indices, would be sub-optimal. Instead, investors should consider the merits of adopting more flexible investment mandates that do not necessitate the disposition of fallen angels, or at least allow for a sufficiently long selling period (perhaps up to two years) in order to benefit from the gradual price recovery.

We previously also argued that the pricing inefficiency and return predictability of fallen angels offer attractive profit opportunities for absolute return investors such as hedge funds, as (simple) rule-based portfolios of fallen angels consistently outperformed peers by about 8.5% per year on average, with information ratios in excess of one. Despite the strong return figures, investors had two key concerns: 1) practical implementation; and 2) the large systematic and idiosyncratic credit risk associated with these strategies.

In this article, we show that despite their supply dynamics, a portfolio invested in fallen angels would be scalable up to a size of $2bn with only minimal degradation in performance. Moreover, while forced selling renders fallen angels less liquid than other high yield bonds, they continue to outperform even after their relatively high transaction costs are taken into account. With respect to mitigating credit risk, we investigate in detail the idea raised in the previous article of using a credit default swap overlay. A rule-based strategy trading the cash-CDS basis of fallen angels achieves a Sharpe Ratio of 3, with over 90% of pairs earning a positive return.

As we demonstrate in this paper, not only does the mean reversion of fallen angels not extend to other high yield bonds, but it is also not evident in equity of fallen angel issuers. A complementary analysis focused on the price reaction of stocks of issuers downgraded to high yield found no evidence of a "correction" in the equity market, while the corresponding bonds exhibited clear mean reversion.

Figure 21: Cumulative Returns of Fallen Angels' Bonds and Equities around the Downgrade



Note: The figure presents the cumulative performance of bonds and equities of fallen angels over peers around the downgrade month. The sample is comprised of all issuers that were downgraded from investment-grade to high yield status as in Ben Dor and Xu (2010) and have both public debt and equity. Equity and bond peer groups are based on 1-digit SIC's and a combination of industry, rating class and maturity, respectively. Source: Compustat, Barclays Capital

These results provide additional evidence that the selling pressure associated with fallen angels is limited to the bond market. The performance stability of the fallen angels strategy over time and its high capacity suggest investors need not engage in market timing based on supply of fallen angels or market liquidity. Increased default risk, likewise, does not seem to be a substantial concern. High yield managers might choose to benefit from these selling pressures via an outright investment in fallen angel bonds. Investors with a mandate allowing the use of derivatives might opt to hedge systematic and idiosyncratic default risk by simultaneously buying protection in the CDS market, possibly also hedging the resulting exposure to market basis risk.

References

Ben Dor, A. and J. Xu. "Fallen Angels. Characteristics, Performance, and Implications for Investors," Barclays Capital, December 2010.

Blanco, R., S. Brennan and I.W. Marsh (2005), "An Empirical Analysis of the Dynamic Relationship between Investment-Grade Bonds and Credit Default Swaps", Journal of Finance 60 (5).

Bolognesi, E., Ferro, M., and A. Zuccheri, "The impact of Fallen Angels on Investment Grade Corporate Bonds portfolios: evidence from the European market", Working Paper, November 2011.

Dastidar, S. and B. Phelps. "Introducing LCS – Liquidity Cost Scores for US Credit Bonds," Barclays Capital, October 2009.

Dastidar, S. and B. Phelps. "Manager Performance Drag from Uncompensated Transaction Costs," Barclays Capital, September 2011.

Desclée, A., M. Ng, B. Phelps, and s. Polbennikov "Replicating Bond Index Baskets (RBI®s1): Performance, Risks, and Alternative RBI Baskets", Barclays Capital, October 7, 2009.

Libor Pospisil and Jing Zhang, 2010, "Momentum and Reversal Effects in Corporate Bond Prices and Credit Cycles." *The Journal of Fixed Income*, Vol. 20, No. 2, 101-115.

McAdie, R. and D. O'Kane (2001), "Explaining the Basis: Cash versus Default Swaps", Lehman Brothers Structured Credit Research, May 2001.

Zhu, H. (2004), "An Empirical Comparison of Credit Spreads between the Bond Market and the Credit Default Swap Market", BIS Working Paper 160.

Analyst Certification(s)

We, Arik Ben Dor, Yael Eisenthal Berkovitz and Jason Xu, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

Important Disclosures

For current important disclosures regarding companies that are the subject of this research report, please send a written request to: Barclays Capital Research Compliance, 745 Seventh Avenue, 17th Floor, New York, NY 10019 or refer to http://publicresearch.barcap.com or call 212-526-1072.

Barclays Capital does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays Capital may have a conflict of interest that could affect the objectivity of this report. Any reference to Barclays Capital includes its affiliates. Barclays Capital and/or an affiliate thereof (the "firm") regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). The firm's proprietary trading accounts may have either a long and / or short position in such securities and / or derivative instruments, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, the firm's fixed income research analysts regularly interact with its trading desk personnel to determine current prices of fixed income securities. The firm's fixed income research analyst(s) receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the investment banking department), the profitability and revenues of the Fixed Income Division and the outstanding principal amount and trading value of, the profitability of, and the potential interest of the firms investing clients in research with respect to, the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays Capital trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. Barclays Capital produces a variety of research products including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations contained in one type of research product may differ from recommendations contained in other types of research products, whether as a result of differing time horizons, methodologies, or otherwise. In order to access Barclays Capital's Statement regarding Research Dissemination Policies and Procedures, please refer to https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-research-dissemination.html.