A NOTE ON STRATEGY BACK-TESTING

The Implications of Compounding Monthly Bond-Level Returns

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- Investors and researchers commonly use monthly bond-level returns to back-test investment strategies.
- Evaluating a strategy's performance using compounded monthly bond-level returns assumes that any cash flows received are reinvested in the same securities that generated the cash.
- If, instead, the strategy uses cash to purchase other securities or simply holds the cash, then back-testing the strategy's performance by compounding monthly bond-level returns is incorrect.
- For certain strategies that may experience sharp price movements, such as those investing in distressed credit bonds, the cash reinvestment assumption can have a large effect on the strategy's measured performance.
- For such strategies, in which cash received is unlikely to be reinvested in the bonds, back-testing should not use compounded monthly bond-level returns. Instead, back-testing should calculate holding period returns using beginning and ending full prices, while keeping track of any cash flows received separately.

Executive Summary

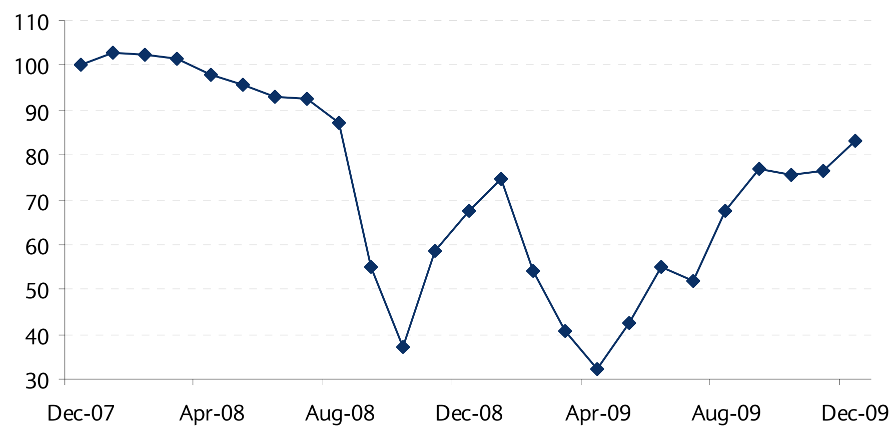
A common approach to back-testing investment strategies is to compute cumulative returns by compounding monthly bond-level index return numbers over the holding period. For strategies that do not generate cash flows (or holding periods over which no cash flows were received), this performance computation method properly reflects what would be the investor's cumulative return. However, if the strategy generates cash flows over the back-testing period, measuring performance by compounding bond-level returns is correct only if any cash would be reinvested in the bonds that paid a coupon. The cash would thereby continue to earn the bonds' returns. Back-testing a strategy's performance using compounded bond-level returns when the strategy would in practice use a different reinvestment policy inaccurately measures the investor's hypothetical performance.

In this note, we illustrate how, in the context of distressed credit investing, alternate reinvestment assumptions can cause back-tested performance to differ compared with using compounded bond-level returns. For such strategies, in which reinvestment is likely to be in a cash vehicle, another approach to measuring back-tested performance is required.

A Single Bond Strategy

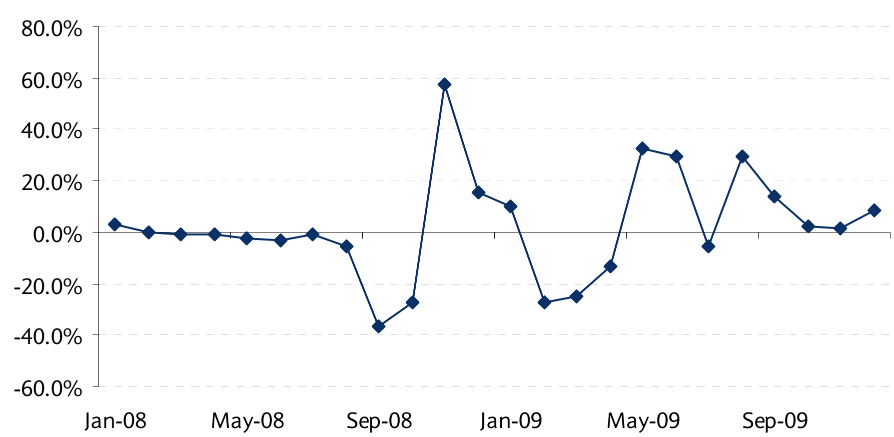
Consider a one-bond example. Figure 1 shows the (Barclays Capital Index) price history of the AIG 5.6% 2016 bond (CUSIP: 02687QBC) from 2008 through 2009. At the beginning of 2008, the bond was trading at a full index (bid-side) price of 100.22. Over the subsequent volatile two years the bond's month-end index price dipped as low as 37.20 before finishing the period at 83.14. Figure 2 shows monthly bond index total returns over the 24-month period.

Figure 1: AIG 5.6% of 2016 Price History; Jan 2008 – Dec 2009



Source: Barclays Capital

Figure 2: AIG 5.6% of 2016 Monthly Index Returns; Jan 2008 – Dec 2009



Source: Barclays Capital

What would the return have been for an investor who owned this bond over the two-year period? To answer this, investors often compound reported monthly bond-level index returns geometrically, as shown below.[1]

$$\text{Cumulative Return} = \prod_{i=1}^{n}(1+ret_i) \qquad (1)$$

[1] The Barclays Capital Index bond-level returns assume that cash received during the month does not earn any reinvestment until month-end, at which time cash is reinvested.

Performing this computation on the AIG bond generates a cumulative holding period return of 3.4% over the two years. Computing cumulative returns in this way assumes that any cash coupon payments are reinvested in the security at the beginning of the month following the cash flow date.

Figure 3 shows the implied evolution of the position in the bond, assuming an initial position of $1mn par. At the end of each month, any coupon payments received are used to buy more of the bond at the month-end (bid) price. As the table shows, four coupon payments were received and reinvested over the period, with the position scaling up from $1mn notional to $1.247mn, a 25% increase. The final market value of $1.036mn reflects a 3.4% return on the initial $1.002mn market value, consistent with the calculation above.

Figure 3: AIG Position Size (mn) Assumed by Compounding Returns; Jan 2008-Dec 2009

Month	Beg Prc	End Prc	Beg Par	Coupon $	Additional Par	End Par	Beg MV	End MV
Jan-08	100.22	103.04	$1.000	$0.000	$0.000	$1.000	$1.002	$1.030
Feb-08	103.04	102.56	$1.000	$0.000	$0.000	$1.000	$1.030	$1.026
Mar-08	102.56	101.65	$1.000	$0.000	$0.000	$1.000	$1.026	$1.016
Apr-08	101.65	98.14	$1.000	**$0.028**	**$0.029**	**$1.029**	$1.016	$1.009
May-08	98.14	95.88	$1.029	$0.000	$0.000	$1.029	$1.009	$0.986
Jun-08	95.88	93.12	$1.029	$0.000	$0.000	$1.029	$0.986	$0.958
Jul-08	93.12	92.51	$1.029	$0.000	$0.000	$1.029	$0.958	$0.951
Aug-08	92.51	87.03	$1.029	$0.000	$0.000	$1.029	$0.951	$0.895
Sep-08	87.03	55.04	$1.029	$0.000	$0.000	$1.029	$0.895	$0.566
Oct-08	55.04	37.20	$1.029	**$0.029**	**$0.077**	**$1.106**	$0.566	$0.411
Nov-08	37.20	58.67	$1.106	$0.000	$0.000	$1.106	$0.411	$0.649
Dec-08	58.67	67.64	$1.106	$0.000	$0.000	$1.106	$0.649	$0.748
Jan-09	67.64	74.60	$1.106	$0.000	$0.000	$1.106	$0.748	$0.825
Feb-09	74.60	54.07	$1.106	$0.000	$0.000	$1.106	$0.825	$0.598
Mar-09	54.07	40.54	$1.106	$0.000	$0.000	$1.106	$0.598	$0.448
Apr-09	40.54	32.20	$1.106	**$0.031**	**$0.096**	**$1.202**	$0.448	$0.387
May-09	32.20	42.67	$1.202	$0.000	$0.000	$1.202	$0.387	$0.513
Jun-09	42.67	55.14	$1.202	$0.000	$0.000	$1.202	$0.513	$0.663
Jul-09	55.14	52.10	$1.202	$0.000	$0.000	$1.202	$0.663	$0.626
Aug-09	52.10	67.57	$1.202	$0.000	$0.000	$1.202	$0.626	$0.812
Sep-09	67.57	77.04	$1.202	$0.000	$0.000	$1.202	$0.812	$0.926
Oct-09	77.04	75.70	$1.202	**$0.034**	**$0.044**	**$1.247**	$0.926	$0.944
Nov-09	75.70	76.67	$1.247	$0.000	$0.000	$1.247	$0.944	$0.956
Dec-09	76.67	83.14	$1.247	$0.000	$0.000	$1.247	$0.956	$1.036

Source: Barclays Capital

Reinvesting Coupon Payments Elsewhere

What if the investor would not, or could not, have reinvested cash flows into the same security? Suppose instead that any coupon payments would have been invested in a cash vehicle that earns a yield of 3%. What would the cumulative return have been in the cases? Figure 4 shows the evolution of the bond plus cash portfolio over time. Any cash payments received are deposited in a cash account at the end of the month, subsequently earning 3% per year.

Figure 4: Portfolio (AIG Bond + Cash) Assuming Coupons Received are Held as Cash Earning 3% Annual Yield; Jan 2008-Dec 2009

Month	Beg Prc	End Prc	Par	Coupon $	End Cash	Beg MV	End MV
Jan-08	100.22	103.04	$1.000	$0.000	$0.000	$1.002	$1.030
Feb-08	103.04	102.56	$1.000	$0.000	$0.000	$1.030	$1.026
Mar-08	102.56	101.65	$1.000	$0.000	$0.000	$1.026	$1.016
Apr-08	101.65	98.14	$1.000	**$0.028**	**$0.028**	$1.016	$1.009
May-08	98.14	95.88	$1.000	$0.000	$0.028	$1.009	$0.987
Jun-08	95.88	93.12	$1.000	$0.000	$0.028	$0.987	$0.959
Jul-08	93.12	92.51	$1.000	$0.000	$0.028	$0.959	$0.953
Aug-08	92.51	87.03	$1.000	$0.000	$0.028	$0.953	$0.899
Sep-08	87.03	55.04	$1.000	$0.000	$0.028	$0.899	$0.579
Oct-08	55.04	37.20	$1.000	**$0.028**	**$0.056**	$0.579	$0.428
Nov-08	37.20	58.67	$1.000	$0.000	$0.057	$0.428	$0.643
Dec-08	58.67	67.64	$1.000	$0.000	$0.057	$0.643	$0.733
Jan-09	67.64	74.60	$1.000	$0.000	$0.057	$0.733	$0.803
Feb-09	74.60	54.07	$1.000	$0.000	$0.057	$0.803	$0.598
Mar-09	54.07	40.54	$1.000	$0.000	$0.057	$0.598	$0.462
Apr-09	40.54	32.20	$1.000	**$0.028**	**$0.085**	$0.462	$0.407
May-09	32.20	42.67	$1.000	$0.000	$0.085	$0.407	$0.512
Jun-09	42.67	55.14	$1.000	$0.000	$0.086	$0.512	$0.637
Jul-09	55.14	52.10	$1.000	$0.000	$0.086	$0.637	$0.607
Aug-09	52.10	67.57	$1.000	$0.000	$0.086	$0.607	$0.762
Sep-09	67.57	77.04	$1.000	$0.000	$0.086	$0.762	$0.857
Oct-09	77.04	75.70	$1.000	**$0.028**	**$0.115**	$0.857	$0.872
Nov-09	75.70	76.67	$1.000	$0.000	$0.115	$0.872	$0.882
Dec-09	76.67	83.14	$1.000	$0.000	$0.115	$0.882	$0.946

Source: Barclays Capital

The change in the reinvestment assumption has a significant effect on the bond's holding period return. Rather than finishing the period with a $1.247mn position in the bond for a MV of $1.036mn, this scenario results in a final portfolio containing the initial $1mn par position in the bond along with $115,000 in cash for a final MV of $0.946mn, a **-5.6% total holding period return**.

One might argue that the low return (and the large difference between it and the return calculated using compounded monthly returns) is the result of an unrealistically low reinvestment assumption. Perhaps the investor, rather than buying more of the AIG bond, would have been able to identify a different investment that yielded 10%, or even 20% per year? Figure 5 shows the hypothetical cumulative holding period return of the AIG bond under various reinvestment assumptions. Although the assumed yield earned on the cash received certainly affects the hypothetical return, even a 10% or 20% return on cash would have resulted in a negative cumulative return. In fact, to actually have earned 3.4% on the AIG position as suggested by compounded monthly returns, the investor would have had to identify an investment earning 62% per year!

Figure 5: Cumulative Return for Various Reinvestment Assumptions; Jan 2008 – Dec 2009

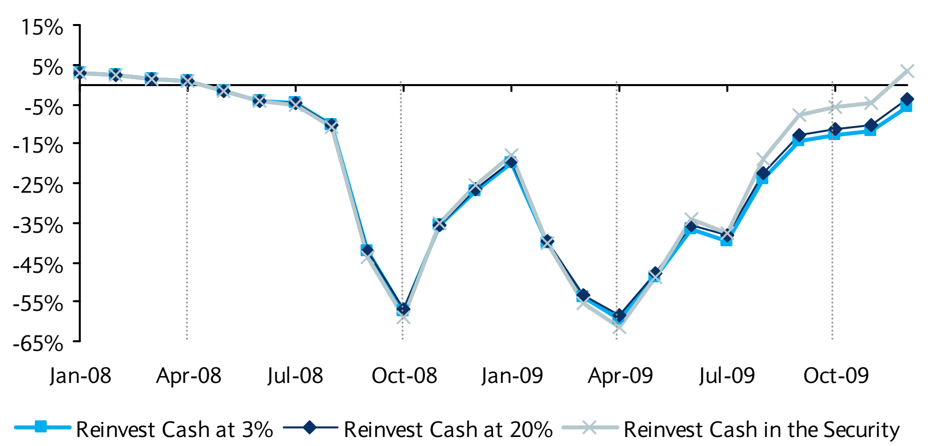
Yield	0%	3%	5%	10%	20%	50%	62%
Return	-5.9%	-5.6%	-5.3%	-4.8%	-3.6%	1.1%	3.4%

Source: Barclays Capital

The AIG bond paid a coupon in October 2008 and April 2009, when its month-end prices were 37.20 and 32.20, respectively. By compounding monthly returns, one assumes the investor used those cash inflows to buy additional notional of the bond at those low prices. When the bond price subsequently rose to 83 by the end of 2009, the newly purchased notional amount exhibited returns sufficient to produce a positive overall cumulative return. Figure 6 shows the cumulative return of the AIG bond under various cash reinvestment assumptions.

Until the bond earns a coupon, the hypothetical cumulative returns under the various reinvestment assumptions are identical. Even after earning coupons, it is only when the bond experiences large price increases or decreases that the deviation becomes noticeable. After receiving its first coupon (for the period) in April 2008, the AIG bond's price declined. Assuming the coupon proceeds were reinvested in the security thus leads to a (slightly) lower cumulative return as of October 2008. During that month, the bond paid another coupon which, under the assumption of security reinvestment, was used to purchase additional principal of the bond at a very depressed price. As the bond's price increased significantly from November 2008 to January 2009, the cumulative return assuming reinvestment in the security exceeded that of the other alternatives. This pattern reverses itself again as the price dipped from February to April 2009 (cumulative return assuming security reinvestment is lower), and yet again as the bond recovered in the remaining eight months of the period.

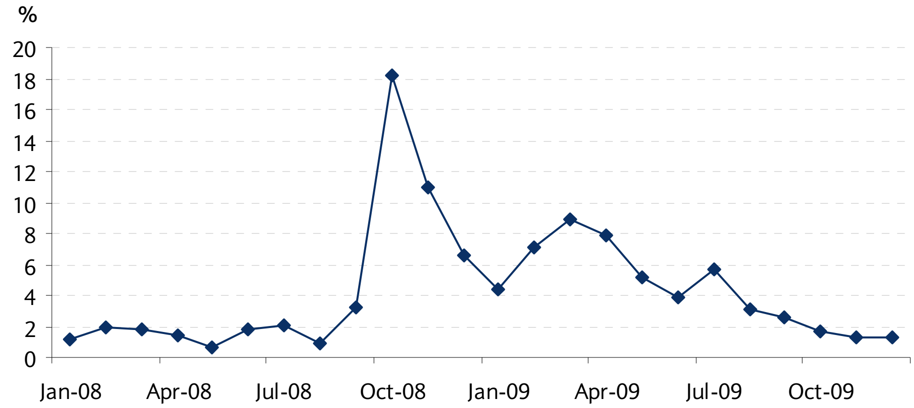
Figure 6: AIG 5.6% of 2016 Cumulative Returns with Various Cash Reinvestment Assumptions; Jan 2008 – Dec 2009



Source: Barclays Capital

Even if an investor had considered reinvesting coupon proceeds into the AIG bond, his decision to do so would have possibly been influenced by a number of factors, such as liquidity. This is particularly true for distressed bonds, the very bonds for which cumulative returns are highly sensitive to the cash reinvestment assumption given their high price volatility. Since distressed bonds tend to be illiquid (i.e., expensive to trade), investors may hesitate to reinvest cash in those securities. Figure 7 shows the month-end Liquidity Cost Score (LCS)™ for the AIG bond over the period. LCS is a bond-level measure of the roundtrip cost incurred from transacting in a security.

Figure 7: Month-end LCS (%) for AIG 5.6% of 2016; Jan 2008 – Dec 2009



Source: Barclays Capital

In October 2008, the AIG bond paid a coupon. At the end of the month, the bond's price had dropped substantially and was trading at 37.20. The method of compounding reported monthly returns assumes that coupon proceeds from October would have been reinvested in more par of the bond at the end of the month. With an LCS of 18.2%, an investor with \$37.20 would have been able to purchase only a notional of \$84.70 of the bond (rather than \$100). Another way to look at this is that only \$31.51 of the \$37.20 would have been used to purchase bonds at the index price; the balance is transactions cost. That raises two issues. First, even if one would have reinvested the cash proceeds in the security, compounding the monthly reported returns does not capture the high LCS and the need to pay more for the bond than indicated by the index price. Whereas we originally computed a compounded return of 3.4% (assuming coupons are reinvested), the return is just 1.7% when incorporating LCS.

More importantly, we must consider whether an investor, having just received income from a distressed, illiquid bond, would realistically choose to use that cash to boost his exposure to the bond. It may be more reasonable to assume that the investor simply holds the income as cash.

As we will show in our sensitivity analysis, the choice of reinvestment assumption will have the largest effect on strategies that have large price appreciation/depreciation following coupon payments. Given that distressed, illiquid bonds often have significant price movements, it is important to choose the appropriate method of calculating cumulative returns when back-testing a strategy involving such bonds.[2] If cash is not reinvested in the bond, then using compounded bond-level returns could substantially overstate the performance of investing in distress bond strategies.

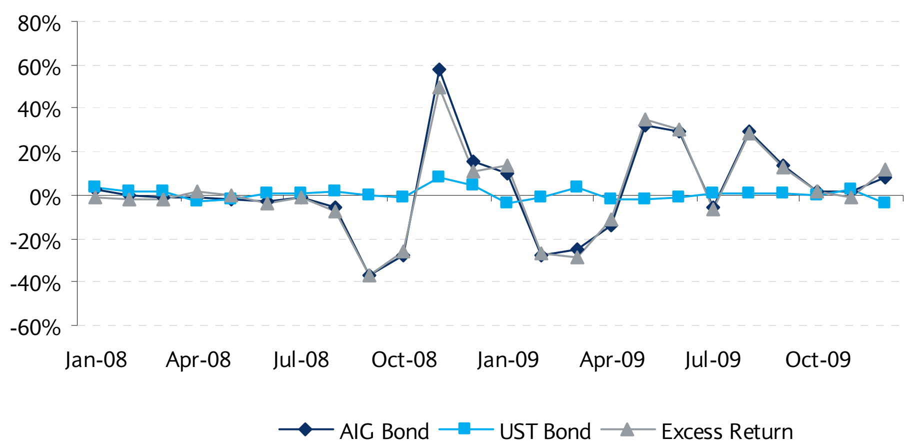
Excess Returns

For some credit investors, excess returns are of greater interest than total returns. What effect does the reinvestment assumption have on excess returns?

[2] This issue influenced how we computed returns for distressed investment-grade bonds in our publication, *The Aftermath of Investment-Grade Distress*, Barclays Capital, January 2012. We chose to assume that cash earned from distressed IG bonds earned 0% and was not reinvested in the bonds. To calculate holding period returns, we used beginning and ending full prices and kept track of any cash flows received during the period. This calculation method generates an average 24-month cumulative absolute return of 51.6% for the 901 bonds in the study. Had we instead compounded monthly returns, the result would have been 57.3%. This average 5.7% point return difference is across 901 bonds!

To consider this, we compare the total return of the AIG bond with the UST 4.625% of 2016.[3] Figure 8 shows the total return of the two bonds and the difference between them (i.e., excess return).

Figure 8: Total Returns for AIG and UST bonds, AIG Excess Returns; Jan 2008 – Dec 2009



What was the cumulative excess return of the AIG bond? We can define cumulative excess returns as follows:

$$\text{CumulativeExRet}_{AIG} = \text{CumulativeTotRet}_{AIG} - \text{CumulativeTotRet}_{UST} \qquad (2)$$

The cumulative total return depends on the reinvestment assumption. For the AIG bond, we found a cumulative total return of 3.4% when assuming coupons were reinvested in the bond and -5.6% when assuming the coupons were invested at 3% per year. When we perform the same computations on the Treasury bond, we find a cumulative excess return of 12.3% when assuming coupons are reinvested in the bond and 12.2% when assuming coupons are reinvested at 3% per year. (The difference in return between the two methods is almost negligible for the Treasury bond because it experienced much smaller price movements following the coupon payments.) This translates into a cumulative excess return of -8.9% when assuming reinvestment in the bond, and -17.8% when assuming reinvestment at 3% per year.[4] Because the Treasury bond portfolio used to compute excess returns will not be nearly as impacted as a distressed credit bond, the choice of reinvestment assumption is as meaningful to excess returns as it is to total returns.

A Multi-Bond Strategy

Of course, it is relatively easy to find single bond examples that highlight this reinvestment issue. (Indeed, there are even more extreme single bond examples.) However, this issue remains relevant for strategies containing more than one bond (i.e., portfolios). To show this, we construct an initially, equal-weighted (by market value) portfolio of the 10 bonds

[3] Barclays Capital reports excess returns that equal the difference in total return between a bond and a portfolio of hypothetical par Treasury bonds matching the bond's key rate duration exposures. Our method of comparing the AIG bond to a Treasury bond with comparable maturity is a simplified form of excess return computation chosen to reflect a more realistic investment alternative. It should be noted that over the 24-month period, the average difference between the reported index excess return and our simplified computation is only 1.7bp/month

[4] For excess returns the yield on cash needed to match compounded returns is actually significantly higher than the case for total returns (123% vs. 62%). This is because increasing the reinvestment rate not only affects the total return of the corporate bond, but also increases the total return of the Treasury. While the corporate bond has a higher yield and, therefore, receives more cash on which to earn the heightened reinvestment rate, the coupons paid by the Treasury bond are also earning a higher return. As such, a yield of 62% is insufficient to bridge the gap.

shown in Figure 9 and back-test the portfolio's performance under various reinvestment assumptions.

Figure 9: Portfolio of 10 Bonds Equally Weighted Initially (as of 12/31/07)

CUSIP	Ticker	Coupon	Maturity	Price
02687QDG	AIG	5.85	1/16/2018	100.72
054536AA	AXASA	8.6	12/15/2030	124.69
06050TJZ	BAC	6	10/15/2036	95.49
14040HAN	C	6.625	6/15/2032	99.55
172967BL	COF	6.15	9/1/2016	90.71
36962G3A	GE	6.15	8/7/2037	106.06
38141GEU	GS	5.625	1/15/2017	97.19
4042Q1AA	HSBC	5.875	11/1/2034	90.79
49327XAB	KEY	5.45	3/3/2016	94.12
61748AAE	MS	4.75	4/1/2014	94.04

Source: Barclays Capital

As for the earlier single-bond example, we look at two reinvestment assumptions: Investing coupon cash back into the securities that paid them versus investing it at a yield of x%/year. In the case of a multi-bond strategy, the most straightforward way to compute cumulative returns is to first compute cumulative bond returns and then arrive at a strategy return by taking the sum product of the bond returns with their initial weight in the portfolio. For a 10-bond portfolio (i = 1 to 10) over 24 months (j=1 to 24), the cumulative strategy return would be computed as shown in equation 3.

$$\text{CumulativeReturn} = \sum_{i=1}^{10} w_i \prod_{j=1}^{24} (1 + ret_{i,j}) \quad (3)$$

Figure 10 shows cumulative total returns for the strategy under various reinvestment assumptions. Although the impact of the reinvestment assumption is less pronounced in the case of the 10-bond strategy compared with a single bond, it is still significant. Had an investor reinvested coupon payments back into the securities that earned them, the strategy would have returned 13.8% over two years. In comparison, holding cash at 0% would have generated a portfolio return of only 10.7%; and reinvesting cash at a yield comparable to that of the corporate index would have resulted in a return of 11.5%. To match the 13.8% return from reinvesting in bonds generating the cash, the portfolio manager would have had to earn 23.6%/year in his reinvestment vehicle.

Figure 10: Multi-Bond Strategy's Cumulative Total Return under Various Reinvestment Assumptions; Jan 2008 – Dec 2009

Cash Flows Invested in:	Cumulative TR
Bonds that generated cash (compounded monthly returns)	13.8%
0%	10.7%
1m LIBOR (avg = 1.6%)	10.8%
Yield of Corp Index (avg = 6.4%)	11.5%
Yield on cash needed to match compounded return	23.6%

Note: Table shows cumulative return for hypothetical strategy under various reinvestment assumptions. A common way of calculating the strategy's return, i.e. compounding monthly bond returns and then aggregating across bonds, suggests that the strategy would have returned 13.8%. To match the return for the strategy without reinvesting in the same securities would have required the investor to identify an investment that earned 23.6%. Source: Barclays Capital

Strategies with a Large Number of Bonds

We can extend the analysis to a much larger, 300-bond strategy. As we did in the other cases, we again evaluate the performance of the strategy under two cash reinvestment assumptions: investing cash in the securities that earned it (compounded monthly returns) and investing cash at a yield of x%/year.

Figure 11 shows the results and compares them with those of the single AIG bond and the 10-bond strategy. The impact of the reinvestment assumption is clearly less meaningful in the context of the 300-bond strategy. This can be understood by looking at the price movement of the large strategy relative to those of the AIG bond and the 10-bond strategy. Whereas the AIG bond's price dipped to as low as 68% less than its beginning of period price and the 10-bond strategy's average price dropped by 32%, the average price of the 300-bond strategy "only" decreased by 19%. As discussed in more detail in the next section, the cash reinvestment assumption (and, hence, the method of calculating cumulative returns) is most impactful when there is significant price increase/decrease following the receipt of cash. Having experienced larger drops in price, the single-bond and 10-bond strategies were able to realize more outperformance potential by reinvesting cash compared with the 300-bond strategy.

This example illustrates, however, that the effect of the reinvestment assumption can remain significant even when back-testing strategies involving a large number of bonds.

Figure 11: Cumulative Total Return under Various Reinvestment Assumptions for Three Strategies; Jan 2008-Dec 2009

Cash Flows Invested in:	AIG Bond	10-bond strategy	300-bond strategy
Bonds that generated cash (compounded monthly returns)	3.4%	13.8%	11.2%
0%	-5.9%	10.7%	9.6%
1m LIBOR (avg = 1.6%)	-5.8%	10.8%	9.7%
Corp Index Yield (avg = 6.4%)	-5.2%	11.5%	10.4%
Yield on cash needed to match compounded return	61.5%	23.6%	12.5%

Source: Barclays Capital

Sensitivity Analysis

We have highlighted the importance of the reinvestment assumption when back-testing a strategy's performance. Under what circumstances will the reinvestment assumption be particularly important? For example, if a bond's full price stays flat after receiving a coupon payment, the compounded monthly return method will not have much impact on the return. In fact, it will effectively assume a 0% return on the cash. As such, it might be helpful to formally show what drives the difference in return numbers computed using the two methods.

Consider a two-period example in which an investor owning a bond receives a coupon, c, at the end of the first period and reinvests the cash in the second period. The bond has full prices of P_0, P_1 and P_2 at the end of period 0 (i.e., the beginning of period 1), period 1 and period 2, respectively. Equation 4 shows the two-period return assuming the cash coupon payment is reinvested in the security. The denominator, Q_0 x P_0, represents the initial market value a position with a notional amount of Q_0. In the numerator, Q_0 x P_2 represents the final market value of the initial notional amount, Q_0. The second term in the numerator represents the final market value of the notional of the bond (Q_0 x c/P_1) purchased at the end of the first period using the coupon proceeds (Q_0 x c).

$$\text{CompoundedReturn} = \frac{Q_0 \times P_2 + \dfrac{Q_0 \times c}{P_1} \times P_2}{Q_0 \times P_0} - 1 = \frac{P_2 + c \times \dfrac{P_2}{P_1}}{P_0} - 1 \qquad (4)$$

In contrast, Equation 5 shows the return of the bond assuming cash is not reinvested in the bond but rather at some reinvestment rate, r, for the second period.

$$\text{SimpleReturn} = \frac{Q_0 \times P_2 + Q_0 \times c \times (1+r)}{Q_0 \times P_0} - 1 = \frac{P_2 + c \times (1+r)}{P_0} - 1 \qquad (5)$$

Equation 6 shows the ratio of the returns computed using the two methods. The conclusion is straightforward. If P_2/P_1 is greater (less) than (1+r), the ratio will be greater (less) than 1. In the case of the AIG bond discussed above, the price appreciation after receipt of the coupons was very large, with the full price dipping to as low as 37 before ascending all the way back up to 83. As such, a return computed assuming cash reinvestment in the security results in a significantly larger cumulative return than when assuming even a 20% reinvestment rate for cash. On the flip side, for a bond whose price drops after paying a coupon, the return computed assuming cash reinvestment in the security will be lower than the return computed assuming a return of r. For bonds that do not experience large price increases or decreases following coupon payments, the two return methods will result in numbers that are very close to each other.

$$\frac{\text{CompoundedReturn}}{\text{SimpleReturn}} = \frac{\dfrac{P_2 + c \times \dfrac{P_2}{P_1}}{P_0} - 1}{\dfrac{P_2 + c \times (1+r)}{P_0} - 1} = \frac{P_2 + c \times \dfrac{P_2}{P_1} - P_0}{P_2 + c \times (1+r) - P_0} \qquad (6)$$

Conclusion

In back-testing strategies, investors often compute cumulative returns by compounding bond-level monthly index returns and aggregating across bonds using initial market weights. While this approach is fairly straightforward, embedded therein is an assumption that cash flows generated during the life of the strategy would have been reinvested into the bond(s) that generate it. For strategies in which the manager would not, or could not, use cash to buy more of the same bond, using compounded monthly returns can be misleading as to the correct back-tested performance.

We have shown that this can have an impact on a strategy of 1, 10, and even 300 bonds. The impact will be largest when back-testing strategies whose bonds experienced large increases or decreases in price following the cash flows. In the case of distressed bonds, for example, cash flows may be received at times when the bond trades at very low prices. The assumption of cash reinvestment in the security implies a significant increase in the investor's position that amplifies the return if/when the bond recovers. As distressed bonds are typically expensive to trade, a strategy that invests in distressed bonds may choose to hold the coupons as cash or invest in other non-distressed securities. As such, back-testing such a strategy by compounding monthly numbers to calculate a cumulative return would not be appropriate.

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