



Low Yields and the Case for Short Duration Benchmarks

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Abstract

Historically, investors with risk time horizons¹ greater than 12 months have been rewarded for extending the duration of funds allocated to bonds, as the return pick-up relative to the incremental downside risk has been large. However, in the current environment the risk/return tradeoff has shifted in favor of short duration bond strategies; this is true even in a stable yields environment. In this paper, we compare the historic risk/return tradeoff of different duration benchmarks to a simulation of future risk/return tradeoffs using today's low yields as the starting point.

Author's Note

All bond index data comes from Merrill Lynch and thus will not be credited at each point going forward. The following indices and their Merrill Lynch index codes were used:

Index	ML Code
US Treasury 1-3 Year	G1O2
US Treasury 1-10 Year	G5O2
US Treasury 10+ Year	G9O2
US Treasury Master	G0Q0

¹ Defined as the amount of time you monitor your returns and care about downside risk.

Historical Returns

Looking back, the decision to allocate money to low duration strategies seems puzzling. If an investor's risk time horizon was longer than twelve months, investing in intermediate strategies seemed to pay off handsomely in the risk/return game. The risk/return metrics of various duration buckets since 1979 illustrate this point.

	Monthly				Rolling 12 Month			
	1-3yr	1-10yr	10+yr	Master	1-3yr	1-10yr	10+yr	Master
Average	0.63%	0.68%	0.83%	0.72%	8.07%	8.69%	10.52%	9.19%
StDev	0.91%	1.31%	3.09%	1.71%	4.56%	5.74%	12.35%	6.99%
Max	7.36%	8.63%	14.58%	9.78%	24.64%	28.55%	56.03%	31.71%
Min	-3.85%	-4.97%	-8.88%	-5.51%	-0.35%	-1.71%	-16.03%	-4.48%
25th Percentile	0.19%	-0.03%	-1.07%	-0.23%	5.37%	4.66%	2.46%	4.33%
10th Percentile	-0.22%	-0.73%	-2.88%	-1.27%	2.30%	2.18%	-4.68%	1.35%
5th Percentile	-0.51%	-1.33%	-4.32%	-2.07%	1.59%	0.66%	-7.71%	-1.43%
1st Percentile	-1.04%	-2.14%	-6.28%	-3.09%	0.59%	-1.45%	-11.37%	-3.67%
Skew	1.60	0.75	0.30	0.46	0.96	0.86	0.73	0.74
Kurtosis	12.94	5.73	1.84	3.26	1.32	0.99	0.90	0.76
#Negative	56	88	125	100	2	13	59	23
%Negative	17.0%	26.7%	37.9%	30.3%	0.6%	4.1%	18.5%	7.2%
Avg Negative	-0.45%	-0.76%	-2.11%	-1.10%	-0.19%	-0.92%	-5.35%	-2.16%

	Rolling 24 Month (Annualized)				Rolling 36 Month (Annualized)			
	1-3yr	1-10yr	10+yr	Master	1-3yr	1-10yr	10+yr	Master
Average	8.21%	8.82%	10.33%	9.27%	8.36%	9.00%	10.62%	9.48%
StDev	3.74%	4.28%	7.99%	4.88%	3.25%	3.45%	5.66%	3.73%
Max	18.66%	20.57%	39.42%	24.40%	16.61%	17.30%	25.37%	18.46%
Min	0.97%	1.29%	-9.74%	-0.41%	2.33%	3.75%	-5.76%	2.72%
25th Percentile	5.86%	5.68%	5.69%	5.59%	6.11%	6.33%	7.52%	6.56%
10th Percentile	3.88%	4.22%	1.94%	3.71%	4.96%	5.22%	5.10%	5.59%
5th Percentile	3.08%	3.15%	-2.71%	2.94%	4.19%	4.77%	-0.41%	4.88%
1st Percentile	1.16%	1.43%	-7.67%	1.73%	2.55%	3.98%	-3.51%	3.33%
Skew	0.71	0.81	0.63	0.84	0.62	0.65	0.01	0.62
Kurtosis	0.28	0.26	1.54	0.47	(0.49)	(0.73)	0.74	(0.61)
#Negative	-	-	22	1	-	-	16	-
%Negative	0.0%	0.0%	7.2%	0.3%	0.0%	0.0%	5.4%	0.0%
Avg Negative			-4.5%	-0.4%			-2.4%	

Figure 1: Historical Risk and Returns

If an investor looked at risk monthly, a case could be made that all of these strategies had too much downside, even the short duration 1-3 year index had a monthly 5th Percentile Value-at-Risk (VaR) of 51bps and lost money 17% of the time. In comparison, the 1-10 year index had a monthly VaR of 133bps and lost money 27% of the time, and the Master Treasury index had a monthly VaR of 207bps and lost money 30% of the time². In exchange for this risk reduction the average return of the 1-3 year was only 5bps less than the 1-10 and 9bps less than the Master.

² The Master Treasury index is a decent proxy for the most popular bond index, the Lehman Aggregate type.

If the risk time horizon is extended, the 1-3 year index looks much less compelling.

	Monthly		Rolling 12 Month	
	1-3 vs 1-10	1-3 vs Master	1-3 vs 1-10	1-3 vs Master
Relative Return	-0.05%	-0.09%	-0.62%	-1.13%
Relative Risk	0.82%	1.56%	0.92%	3.02%

	Rolling 24 Month		Rolling 36 Month	
	1-3 vs 1-10	1-3 vs Master	1-3 vs 1-10	1-3 vs Master
Relative Return	-0.60%	-1.06%	-0.64%	-1.12%
Relative Risk	-0.07%	0.14%	-0.58%	-0.69%

Figure 2: Historical Risk/Return Tradeoffs vs. the 1-3 Year Index³

If an investor’s risk time horizon was twelve months, the 1-10 year index became a bit more attractive in comparison to the 1-3 year index. In exchange for 62bps of excess return, only 92bps of extra downside risk was assumed. Buying the Master still adds a lot of additional risk (302bps) while offering only 113 bps extra return.

Investors who measure risk in two year periods were clearly inefficient by investing in short duration benchmarks. Compared to the 1-10 year index, the 1-3 had more downside risk and cost an investor 60bps. An investor in the Treasury Master earned an extra 106bps with only 14bps of additional downside risk. For investors with three year time horizons the 1-3 had more downside risk and a lower return than both the 1-10 and the Master.

For investors with a time horizon longer than twelve months there was clearly no reason to be invested in short duration benchmarks. Even in the twelve month case the 1-10 year index seems to have offered a better risk/reward tradeoff.

The Trouble with History

The trouble with looking at current allocations through this historical lens is that the situation has changed. Yields are at very low levels and even if they do not rise, it seems unlikely (in some sense mathematically impossible) for them to fall as they have since 1979. Looking at a chart of the yield on the various indices illustrates this point nicely.

³ This table uses the 5th Percentile VaR as the measure of risk. Negative numbers in the return rows are the amount of underperformance the 1-3 year has had on average. Positive numbers in the risk rows are the amount of risk reduction the 1-3 year index has had. In all cases positive numbers are “good” for the 1-3 year index

US Treasury Yields

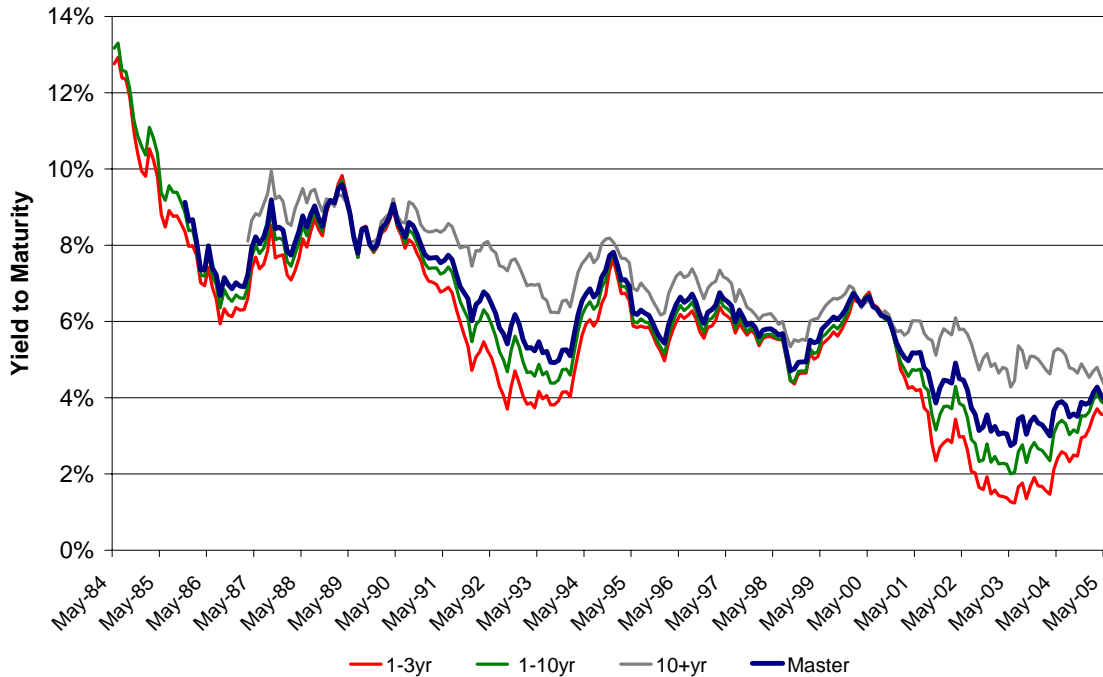


Figure 3: US Treasury Yields over Time

	1-3yr	1-10yr	10+yr	Master
Average Yield	5.83%	6.22%	6.91%	6.19%
Current Yield	3.62%	3.86%	4.21%	3.95%
Off Average	-2.21%	-2.36%	-2.70%	-2.24%

Figure 4: Current Yields vs. History

The simple fact is that yields are much lower now than in the historical period we examined above. This has two effects on allocations made today. First, it reduces the expected return universally; the best estimate for future returns on bonds is the yield to maturity, especially when falling yields will not add too much to capital gains.

Second, the low yield environment adds to the risk of bond portfolios. This occurs in two ways, one obvious and one subtle. The obvious way is it changes the mean of the distribution of returns. If the yield on a five year duration bonds rises 10bps in one month, the price loss will be 50bps. Now, if yields start at 6%, the monthly income will be 50bps and thus there will be a total return of 0bps. If, on the other hand, yields start at 3%, the monthly income will only be 25bps and an investor will have a 25bps loss for the same yield move.

The subtle effect is that durations for the same maturity are longer when yields are low⁴. When yields are 6.19%, the duration of a five year par bond is 4.25 years. However, when yields are 3.95%, the duration for a five year par bond is 4.50 years. Accordingly,

⁴ Since the present value of the future cashflows is higher.

for the same 10bps change in yields the price loss will 2.5bps more in the low yield environment. Essentially these effects increase the risk of owning bonds, and thus the risk/return tradeoff, for short duration portfolios.

Simulation

To measure the new risk/reward tradeoff, we simulate the returns of the bond indices going forward using a random walk yield model. The yield path is simulated using a modified discrete Cox, Ingersoll and Ross model⁵. The modification being we ignore the mean reversion properties and just focus on the volatility part of the model. Thus the random walk of yields is governed by the equation:

$$\Delta r = \sqrt{r} \sigma \varepsilon \sqrt{\Delta t}$$

Equation 1: Interest Rate Random Walk

Where

Δr = change in interest rates

r = the current interest rate

σ = the volatility of interest rates divided by $r^{.5}$

ε = a random drawing from a standardized normal distribution

Δt = the time step of the simulation (in this case 1/12 for monthly)

The unscaled annualized volatilities we used are the historical ones (scaled by the sqrt(r) to put them in the CIR framework) which corresponded to:

	1-3yr	1-10yr	10+yr	Master
Yield Vol	1.13%	1.12%	0.87%	1.00%

Figure 5: Model Volatilities

A case could be made that we are in a much lower than historical volatility environment. There are two responses to that. The CIR scaling enforces some of that as the square root of r is lower when r is lower. Second, it is unclear that volatility will stay low, and for asset allocation risk modelers, we think it is better to err on the side of caution here.

We can then create a simulation where the return for any given month will be equal to:

$$ret = \left(\left((1 + r_t)^{\frac{1}{12}} \right) \cdot (\Delta p) \right) - 1$$

Equation 2: Period Return

And

$$\Delta p = (\Delta r \cdot dur) + \left(\frac{1}{2} \cdot cx \cdot \Delta r^2 \right)$$

Equation 3: Price Return

⁵ Cox, Ingersoll, and Ross. "A Theory of the Term Structure of Interest Rates". *Econometrica*, 53 (1985). 385-407

Where:

ret = the return for the period

rt = the yield at the start of the period

Δr = the change in yields determined by the random walk

dur = the duration of the bond at the current yield

cx = the convexity of the bond at the current yield

The simulation was run 1000 times to get a good distribution of probable returns. The runs were not biased with higher or lower yields but were allowed to fluctuate randomly around the current yield according to the CIR model without mean reversion. The results of the simulation look as follows:

	Monthly				Rolling 12 Month			
	1-3yr	1-10yr	10+yr	Master	1-3yr	1-10yr	10+yr	Master
Average	0.30%	0.32%	0.40%	0.34%	3.65%	3.95%	4.92%	4.17%
StDev	0.56%	1.18%	3.09%	1.83%	1.43%	3.56%	10.92%	6.11%
Max	2.00%	3.88%	11.64%	6.81%	7.14%	12.98%	41.00%	18.44%
Min	-1.57%	-3.99%	-9.92%	-5.31%	-1.16%	-7.18%	-30.03%	-14.88%
25th Percentile	-0.08%	-0.48%	-1.70%	-0.90%	2.78%	1.52%	-2.10%	-0.06%
10th Percentile	-0.42%	-1.19%	-3.51%	-1.99%	1.70%	-0.61%	-7.99%	-3.88%
5th Percentile	-0.63%	-1.60%	-4.56%	-2.64%	1.11%	-2.07%	-13.17%	-6.11%
1st Percentile	-1.00%	-2.38%	-6.65%	-3.88%	-0.12%	-4.97%	-20.20%	-10.70%
Skew	0.01	(0.01)	0.11	0.08	(0.41)	(0.26)	0.24	(0.12)
Kurtosis	3.01	3.08	3.17	3.06	3.10	2.74	3.34	2.68

	Rolling 24 Month (Annualized)				Rolling 36 Month (Annualized)			
	1-3yr	1-10yr	10+yr	Master	1-3yr	1-10yr	10+yr	Master
Average	3.64%	3.91%	4.62%	4.06%	3.62%	3.89%	4.53%	4.02%
StDev	0.79%	2.14%	7.38%	3.92%	0.62%	1.56%	5.82%	2.99%
Max	5.91%	9.13%	26.04%	12.66%	5.42%	7.07%	23.44%	10.78%
Min	1.10%	-4.77%	-20.57%	-9.03%	1.26%	-2.50%	-12.68%	-5.56%
25th Percentile	3.13%	2.61%	-0.70%	1.36%	3.21%	2.95%	0.58%	2.15%
10th Percentile	2.53%	1.02%	-5.12%	-1.17%	2.87%	1.78%	-3.15%	0.07%
5th Percentile	2.24%	0.38%	-6.97%	-2.62%	2.54%	1.10%	-5.84%	-1.11%
1st Percentile	1.60%	-1.53%	-11.27%	-5.88%	2.04%	-0.99%	-8.88%	-3.76%
Skew	(0.36)	(0.44)	0.05	(0.18)	(0.21)	(0.77)	(0.10)	(0.39)
Kurtosis	3.03	3.12	2.81	2.82	3.35	3.80	2.87	3.04

Figure 6: Simulation Results

What should not be surprising is the expected returns are all much lower than the historical returns. As we mentioned, yields 250bps lower than average should reduce expected returns by 250bps. Plus, without more capital gains from falling yields, the returns are reduced even further. In addition, the downside risk is higher in all cases because of the two effects we previously mentioned⁶.

⁶ Interestingly the volatility of returns is basically the same, if not lower, than the historical series. This occurs despite the current environment being more “risky” than the historical time period. This volatility conundrum presents further evidence that downside risk measures such as VaR are more appropriate when choosing investments than volatility.

	Monthly		Rolling 12 Month	
	1-3 vs 1-10	1-3 vs Master	1-3 vs 1-10	1-3 vs Master
Relative Return	-0.02%	-0.05%	-0.30%	-0.52%
Relative Risk	0.97%	2.01%	3.18%	7.21%

	Rolling 24 Month		Rolling 36 Month	
	1-3 vs 1-10	1-3 vs Master	1-3 vs 1-10	1-3 vs Master
Relative Return	-0.28%	-0.42%	-0.27%	-0.40%
Relative Risk	1.86%	4.86%	1.44%	3.66%

Figure 7: Simulated Risk/Reward Tradeoffs vs. the 1-3 Year Index

The risk/reward tradeoff now heavily favors investing in 1-3 year bonds. Since we are assuming no systematic capital gains from lower yields, the return difference is basically the extra carry from the initial yield difference⁷.

The risk reduction in the short duration index is much larger than in history due to the previously mentioned effects. Even with three year time horizons there are significant risk reductions without much expense in expected return. With a three year time horizon an investor in the 1-3 year index only sacrifices 40bps of return in exchange for 366bps less downside risk.

Conclusion

The historically maligned short duration benchmarks look quite attractive in today’s low yield environment. The sacrifice in return relative to the decrease in risk has moved in favor of the short duration benchmark. Without the capital gains of further decreases in yield, it is not possible for longer duration portfolios to match the risk adjusted returns of short duration benchmarks.

Systematic drops in yield are still possible, but consider that since 1985 the yield on the Treasury Master index has fallen from 9.13% to 3.95% or 518bps. It is mathematically impossible for it to fall that much again. If an allocator believes that yields may continue to fall, the best advice would be to pick the short duration benchmark and allow the manager to take active duration bets to add value. The systematic fall in yields will not lift the return of longer benchmarks enough to warrant an allocation of “Beta” to them. The Merrill Lynch 1-3 has historically been the benchmark of choice but the Lehman Aggregate 1-3 offers a good alternative that contains the spread sectors managers use to add value.

⁷ There is also the convexity effect where longer duration non-callable bonds have more convexity. The value of convexity is approximated with the equation $ER_{cx} = .5\left(\frac{1}{2} \cdot cx \cdot vol^2\right)$. This is always positive for non-callable bonds and adds to the return of the longer duration indices.