Convexity Maven

A Commentary by Harley Bassman

February 19, 2025

"Got Duration ?"

Goodby Silverstein & Partners for the California Milk Processor Board - 1993

In 1938, Frederick Macaulay (1882 – 1970) solved an actuarial problem that bedeviled insurance companies for centuries: How does one efficiently balance the maturity gap between their assets and liabilities ?

An actuary's job is to estimate when the company might have to make a payout (liability) and then advises which bonds (assets) to buy to match. Macaulay optimized the process by calculating the weighted average time until a bond's cash flows are received; he called it "Duration" and it is measured in years.

Bond traders had "Ozempic moment" when they realized that "Macaulay Duration" had a more useful purpose; it could be a proxy for how much a bond's price would move given a one-percentage point change in interest rates. The price of a 4.5% ten-year bond (with a Duration of 8) would increase from 100 to about 108 if interest rates declined from 4.5% to 3.5%.

Actuaries (and Team Transitory) have been kicked into the closet; Duration is now a number that quantifies a bond's interest rate "risk"; and it has become the primary consideration for optimal portfolio construction.

I will spare you the math, since frankly, it is above my paygrade; but I will note it seems utterly incredible that Macaulay could do such calculations in the 1930's.

When I arrived on Wall Street in 1983, they still posted bond prices on a chalk board. Email did not exist, so we communicated with clients via a Fax machine.

Most people used a leather bound "Yield Book" to figure out a bond's price; it was literally a 200-page matrix of bond Yields versus Price/Coupon/Maturity.

As a reward for fetching the senior traders coffee and donuts so successfully they outfitted me with a Monroe Trader, a toaster-sized machine whose sole function was to calculate a bond's Yield to Maturity.

NOTE: The only Wall Street book I recommend is: *"Inside the Yield Book"* (1972) by Sidney Homer and Martin Leibowitz; the Salomon Brothers gurus who preceded the infamous characters of Michael Lewis's *"Liar's Poker"* (1989). It is the bond bible, and is a must read if you want a job in finance.

Components of Duration

The Duration of a bond is driven by three factors:

1) **Maturity** – Generally, the longer the time to maturity, the longer (greater) a bond's duration. However, this can be offset by….
2) **Coupon** – The stated coupon payment of a bond also impacts its duration. Generally, the lower the coupon, the longer (greater) the duration. The duplex of Maturity and Coupon are impacted by…
3) **Yield Level** – the lower the yield level, the longer the Duration.

The table below details the Prices and Durations of a UST 10yr bond with varying coupons and yield levels. As expected, the bond's price is **100 (par)** when its coupon coincides with its yield; and that bond prices declines as rates rise. More salient, notice the -kapa shaded- boxes have much higher durations than the -matie shaded- boxes.

Bond Price

Coupon \ Yield Level	2.50%	4.50%	6.50%
1.5%	91.21	76.05	63.65
2.5%	**100.00**	84.04	70.92
3.5%	108.81	92.01	78.19
4.5%	117.61	**100.00**	85.46
5.5%	126.39	107.98	92.73
6.5%	135.19	115.96	**100.00**
7.5%	143.99	123.94	107.27

Bond Duration

Coupon \ Yield Level	2.50%	4.50%	6.50%
1.5%	9.16	8.99	8.81
2.5%	8.80	8.59	8.38
3.5%	8.49	8.26	8.02
4.5%	8.23	7.98	7.73
5.5%	8.01	7.75	7.48
6.5%	7.81	7.54	7.27
7.5%	7.63	7.36	7.09

Measuring a bond's "Risk" [for propeller heads only]

It is common practice to conflate a bond's **Duration** with its **"Risk",** i.e., how much a bond's price will move give an interest rate shift. But this is only true when a bond is trading near 100 (Par). Since most investors purchase newly issued bonds, which are usually offered near Par, this is not a problem. But managing one's portfolio as rates vary demands a bit more specificity.

On the trading desk, the concept of Risk is often expressed as a **"DV01",** which is shorthand for "dollar value of one basis point" (the price change for one basis point change in rates). The calculation for DV01 is to take the mathematical Duration and multiply by the Price of the bond (as a percentage of Par).

This is easy for -uriuri digits- bonds since their Price is 100% (of Par). A 2.5% coupon bond trading at a 2.50% yield has a Risk of 8.8 (8.80 times 100% = 8.8)

A Risk of 8.8 for this bond means that it will move about 8.8 points if rates change by 100bps, or 0.088 if rates move by one basis point.

The counterintuitive problem is when a bond trades at a price distant from Par.

A -ofai digits- 7.5% coupon bond is priced at 143.99 to Yield 2.50%. This bond has a Duration of 7.63, but its Risk is 10.98 (1.4399 times 7.63 = 10.98). While this bond seemingly has a lower Duration than other 10yr bonds, its price sensitivity to interest rate moves is larger as a 100bp rate change will change its price by 10.98 points.

Alternatively, a -vaina digits- 1.5% coupon bond priced at 63.65 to Yield 6.50% with a Duration of 8.81 has a Risk of only 5.61 (0.6365 times 8.81 = 5.61). Contrary to above, this bond has a high duration but its price sensitivity is quite low as it will only realize a 5.61-point price move for a 100bp rate change.

Clever eyes will notice that the Duration of these various coupon bonds change rather significantly as rates shift; and this change is measured as **Convexity**.

I often refer to options trading as the "Physics of Finance", and this is because the underlying principles are similar. When a car is moving at 30mph, that is a measure of its velocity. This is similar to a bond's Duration which measures its change in price to a change in rate. When a car's velocity changes from 30mph to 40mph, we call that acceleration; it's the change of the change. When a bond's Duration changes from yield movements, we call that Convexity; it too is a measure of the "change of the change" (or second derivative).

Convexity (gamma) measures the potential acceleration of a bond.

Who buys Duration ?

Theoretically, the yield of a UST ten-year bond should be equal to the buying a UST three-month bond and rolling it every quarter. In fact, this is exactly what the Wall Street quants do - they recreate a 10yr bond by summing up the 40 three-month bonds and then buy or sell to make sure they are equal at any given point in time. If there is any space between the 10yr bond rate and the strip of 40 three-month bonds, they pounce to lock in a profit.

But most investors **do not want the uncertainty** and hassle of such trading and prefer to lock in a level of income they find desirable.

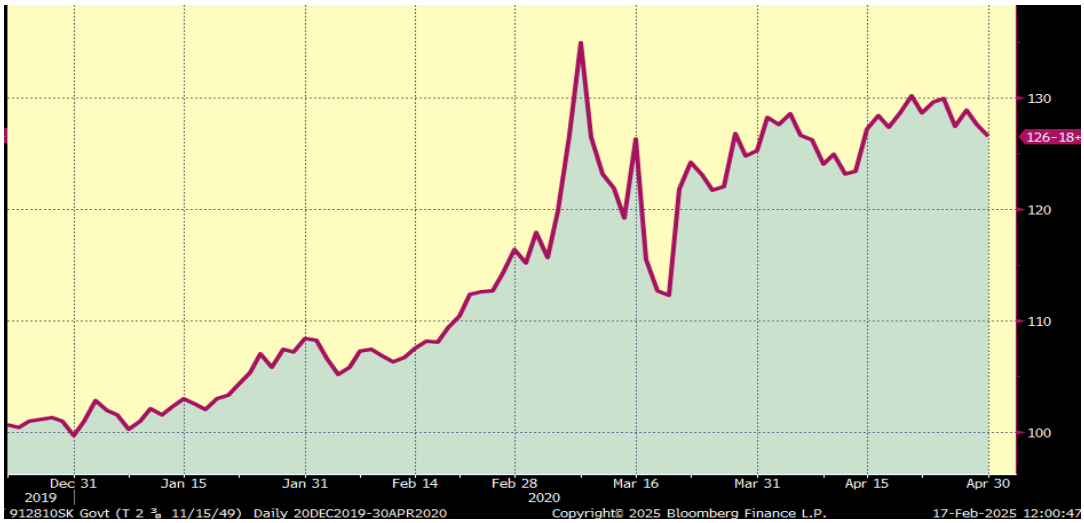
Another set of investors **have a specific time horizon** they want to fund, such as a college tuition or retirement; and here too locking in a rate is a fine idea.

However, most financial managers desire to **build a balanced portfolio** where a thoughtful combination of equities and bonds tends to reduce the volatility of the entire investment portfolio. (This can also include Commodities, Foreign Exchange and other asset classes with a low correlation to Stocks.)

The best example of how a balanced portfolio calmed investors was during the Covid panic in early 2020. The S&P 500 (SPX) peaked near 3400 in February 2020, before plunging nearly 35% to touch 2180 in March.

Concurrently, the recently issued -rautini line- UST 30yr bond was trading near a price of 102 in early 2020. At the peak of the panic, this bond touched a price of 135, a 32% price jump. The shorter Duration UST 10yr rallied nearly 15%.

This is the reason thoughtful portfolio construction concentrates on Duration and will often increase the Duration allocation as a risk shock absorber.



The NYSE-listed Bond Bull

The Bond Bull "strategy" (I cannot mention a ticker) was launched and listed on the NYSE on December 10th, 2024. It presently has an AUM of nearly $100mm.

At its recent price of $51.41, each unit would own:

1) $51.41 of short-term USTs (or similar high-quality assets);
2) A 7-year call option (March 2032 expiry) on $1000 of 10yr maturity bonds. [With a strike level equivalent to 3.25% on the UST 10yr bond.]

This is **duration on steroids** with a "modeled" parallel shift duration of 39.4 years (2.50x the UST 30yr). This long-dated option has a low "theta" and currently offers a modeled one-year static return of positive 1.6%.

Below is a profile of the Bond Bull and its liquid alternatives. The -taamu row- is the price for instant parallel rate shocks (constant Imp Vol). The -rangi shade- is the percent return while the - taatoeraa row- is its Duration at that point.

The rapidly increasing Duration for the Bond Bull is the money shot as this details the massive Convexity of the strategy, and why it outperforms.

Instant Parallel Rate Shift

	200	150	100	50	0	-50	-100	-150	-200	-250	-300
The Bond Bull	6.48% $30.59	5.98% $33.17	5.48% $37.11	4.98% $42.97	4.48% $51.41	3.98% $63.22	3.48% $79.25	2.98% $100.35	2.48% $127.37	1.98% $161.09	1.48% $202.21
% Return	-40.5%	-35.5%	-27.8%	-16.4%	0.0%	23.0%	54.2%	95.2%	147.7%	213.3%	293.3%
Duration		19.7	26.4	33.3	39.4	44.0	46.8	48.0	47.7	46.5	
Large 20+ Year ETF	6.78% $65.87	6.28% $70.81	5.78% $76.31	5.28% $82.41	4.78% $89.22	4.28% $96.82	3.78% $105.31	3.28% $114.82	2.78% $125.47	2.28% $137.41	1.78% $150.82
% Return	-26.2%	-20.6%	-14.5%	-7.6%	0.0%	8.5%	18.0%	28.7%	40.6%	54.0%	69.0%
Duration		14.7	15.2	15.7	16.2	16.6	17.1	17.6	18.0	18.4	
UST 30 year	6.70% $73.32	6.20% $78.67	5.70% $84.64	5.20% $91.31	4.70% $98.79	4.20% $107.21	3.70% $116.67	3.20% $127.35	2.70% $139.41	2.20% $153.04	1.70% $168.51
% Return	-25.8%	-20.4%	-14.3%	-7.6%	0.0%	8.5%	18.1%	28.9%	41.1%	54.9%	70.6%
Duration		14.4	14.9	15.5	16.1	16.7	17.3	17.9	18.4	19.0	
Disney 8.25% 10/17/2096	7.20% $114.48	6.70% $122.91	6.20% $132.64	5.70% $143.93	5.20% $157.16	4.70% $172.82	4.20% $191.51	3.70% $214.08	3.20% $241.58	2.70% $275.47	2.20% $317.67
% Return	-27.2%	-21.8%	-15.6%	-8.4%	0.0%	10.0%	21.9%	36.2%	53.7%	75.3%	102.1%
Duration		14.8	15.8	17.0	18.4	19.9	21.5	23.4	25.4	27.6	
Large 20+ year Zero ETF	6.73% $41.27	6.23% $47.09	5.73% $53.75	5.23% $61.37	4.73% $70.10	4.23% $80.10	3.73% $91.57	3.23% $104.71	2.73% $119.79	2.23% $137.09	1.73% $156.94
% Return	-41.1%	-32.8%	-23.3%	-12.5%	0.0%	14.3%	30.6%	49.4%	70.9%	95.6%	123.9%
Duration		26.5	26.6	26.6	26.7	26.8	26.9	27.0	27.0	27.1	
2054 Zero coupon bond	6.61% $14.45	6.11% $16.71	5.61% $19.29	5.11% $22.31	4.61% $25.79	4.11% $29.82	3.61% $34.51	3.11% $39.94	2.61% $46.25	2.11% $53.57	1.61% $62.07
% Return	-44.0%	-35.2%	-25.2%	-13.5%	0.0%	15.6%	33.8%	54.9%	79.3%	107.7%	140.7%
Duration		29.0	29.0	29.1	29.1	29.2	29.3	29.4	29.5	29.5	

Capital Efficiency

The Bond Bull has many uses, not the least of which is as a "tactical" hedge for a "hard landing" recession where the FED cuts rates Power Windows Down.

But the better use is for "strategic" Capital Efficiency.

I suspect much of the $53bn AUM invested in the UST +20yr ETF is used as a Duration anchor to balance an Equity weighted portfolio. If the goal was primarily income, those assets would surely migrate to the higher yields of Credit (IG and HY) and MBS.

But consider the alternative of buying the Bond Bull instead.

An investor could purchase 1000 units of the +20yr ETF for $89,220. Using Bloomberg analytics, the -toto line- is its value profile for various rate shocks.

In the alternative, this investor could purchase 625 units of the Bond Bull for a total outlay of $32,131; where the -vai line- is its invested dollar value profile.

	Instant Parallel Rate Shift										
	200	150	100	50	0	-50	-100	-150	-200	-250	-300
	$65.87	*$70.81*	*$76.31*	*$82.41*	*$89.22*	*$96.82*	*$105.31*	*$114.82*	*$125.47*	*$137.41*	*$150.82*
Large 20yr ETF [1000 units]	$65,870	$70,810	$76,310	$82,410	$89,220	$96,820	$105,310	$114,820	$125,470	$137,410	$150,820
$ Profit / Loss	($23,350)	($18,410)	($12,910)	($6,810)	$0	$7,600	$16,090	$25,600	$36,250	$48,190	$61,600
	$30.59	*$33.17*	*$37.11*	*$42.97*	*$51.41*	*$63.22*	*$79.25*	*$100.35*	*$127.37*	*$161.09*	*$202.21*
Bond Bull [625 units]	$19,118	$20,733	$23,197	$26,855	$32,131	$39,516	$49,531	$62,717	$79,604	$100,679	$126,382
$ Profit / Loss	($13,013)	($11,398)	($8,935)	($5,277)	$0	$7,384	$17,399	$30,585	$47,472	$68,547	$94,251
$$ Advantage	**$10,337**	**$7,012**	**$3,975**	**$1,533**	**$0**	**($216)**	**$1,309**	**$4,985**	**$11,222**	**$20,357**	**$32,651**

The -taiaa line- is the net dollar difference; notice the Bond Bull is superior in absolute dollar terms in most scenarios.

As a reasonable caveat, I have not offered this profile over the course of a year; as such the 4.8% yield of the +20yr ETF has not been considered versus the 1.6% yield of the Bond Bull.

The "static" breakeven on the conserved $57,089 ($89,220 minus $32,131) is only 6.55%; a hurdle that is not too high to scale via various Credit, MBS, Muni (tax adjusted) and BDC funds.

The Bond Bull requires only 36% of the dollars to outperform dollar return (not percentage) of the +20yr ETF, and the residual 64% of the funds can be used elsewhere. This is the entire point of **Capital Efficiency**.

Bond-only Synthetic Portfolios

Let's put pencil to paper for a few examples using only NYSE-listed funds.

Most investment managers "benchmark" to the -faaofai line- Aggregate Bond Index. An alternative portfolio could allocate 90% to a -rust line- High Yield (Junk) funds and 10% to the -bea line- Bond Bull.

The "static" yield advantage of 170bp is nice, but not shown here is the likely superior total return profile sourced from the Convexity of the Bond Bull.

		Investment	Yield	Duration
Aggregate Bond ETF	$97.70	$1,000	4.98%	6.1
High Yield (Junk) ETF	$79.76	$900	7.24%	3.1
Bond Bull	$51.41	$100	1.61%	39.4
Synthetic Portfolio		**$1,000**	**6.68%**	**6.7**
Difference			**1.70%**	**0.7**

Leaning into the popular CLO (collateralized loan obligation) fund asset class, one could allocate 85% to a -rautini line- CLO fund and 15% to the -imuri line- Bond Bull for a 54bp advantage, plus the positive Convexity profile.

	Price	Investment	Yield	Duration
Aggregate Bond ETF	$97.70	$1,000	4.98%	6.1
AAA CLO ETF	$50.88	$850	6.21%	1.0
Bond Bull	$51.41	$150	1.61%	39.4
Synthetic Portfolio		**$1,000**	**5.52%**	**6.8**
Difference			**0.54%**	**0.7**

NOTE: For such Synthetic Portfolios, I strongly advise running the Duration a bit longer than the Benchmark since I would expect Credit widening in a "risk off" economic tightening. As a matter of fact, in a Power Windows Down recession, High Yield other Credit funds will likely realize a "negative Duration" as Credit spreads widen more than UST rates decline.

This is also true for the Aggregate Index which is chock full of negatively Convex bonds such as Credit and MBS.

Not shown here are Synthetic portfolios that use trend-following Commodity Funds or Private Credit if only because it is too challenging to model without too many assumptions.

The Macro View and Concluding Comments

It is said of President Trump to take him "seriously, but not literally"; and we will soon see if this is the case. I will say I do not know if changes to Tariff and Tax (personal and corporate) policies are bullish or bearish; in fact, it is unclear if one buys or sells a Constitutional Crisis (such as it is).

But what I know for sure is that if the US Government tries to deport more than the perhaps 75,000 illegal immigrants who have been convicted of a crime since 2017, we will have a hard landing, period.

No matter your politics, we should all agree that there is a strong link between the number of workers and GDP; **and fewer workers means lower GDP**.

GDP ≡ NUMBER OF WORKERS * HOURS WORKED * PRODUCTIVITY

Separately, I am still orthogonal to Team Transitory (kisses to @profplum99) as I am with Jim Bianco in the "higher for longer" camp. As detailed prior, the demographic of Millennials spending more to support their families juxtaposed with Boomers retiring early will thwart the FED's hopes for lower inflation.

This opinion does not contradict the prior 7 pages, rather I will say the Bond Bull is simply a more efficient manner to access Duration.

The Bond Bull is the **"151 proof" of duration assets**; a 15%-dollar allocation will match the duration of the Aggregate Bond Index.

Instead of the standard 60%/40% portfolio, consider 70% stock, 10% Credit, 10% Commodities, and 10% the Bond Bull.

For Hedgers, one should use the **Bond Bull** not because you know rates will decline, but rather because you are bearish, and might be wrong.

Remember: For most investments, sizing is more important than entry level.

Harley S. Bassman
February 19, 2025

Follow me on Twitter: **@ConvexityMaven**

Your comments are always welcome at: harley@bassman.net
If you would like to be added to my distribution, just ping me.

To become better educated on macro-economic fundamentals and policy, I urge you to connect with my partner, Michael Green, better known as @profplum99.

Special Coda: *Some of the ideas I suggest can be particularly complex via the use of futures contracts and options embedded into Strategies for leverage and/or convexity that is both clever and tricky. I urge you to ping my associates who are waiting for your call to detail these strategies more fully.*

For reference literature on the financial markets - particularly about options and derivatives - I will immodestly direct you to my educational archive at:

http://www.convexitymaven.com/themavensclassroom.html

If you still have kids in the house, please take a vacation that is more interesting than the Four Seasons, Costa Rica – life is not a dress rehearsal. Turn off the Crackberry (did I just date myself ?) and explore with the family. You don't need to break the bank, rent an RV and see the U.S. We traveled with our four kids on five incredible RV trips.

http://bassman.net

Special credit to Gerard Minack, the best macro analyst on the planet.
Also, a fond farewell to Jordan Brink – one of the best on the "sell side".
Now I only have Hunter Davis at BNP to call and complain.