# **The Convexity Maven**

A Commentary by Harley Bassman

June 8, 2021

# "Fire Insurance"



Except for grifters practicing insurance fraud, no one buys fire insurance in hopes of their house burning down. This is the corollary to the epilogue of my prior Commentary that noted that "buyers of life insurance do not win when they die".

If you are reading this Commentary, there is little doubt that you have purchased an insurance policy, likely multiple policies such as auto, home, personal property, and liability. (I will ignore life insurance; obviously.) These sorts of products offer the challenge of both quality (coverage and deductible) as well sizing (total payout).

Today we will take a deeper dive into an interest rate insurance Strategy outlined in my recent Commentary "*The Helicopter Defense*" – May 13, 2021.

# The Strategy

At inception, a purchase of \$50 of the Strategy would entail:

Buying \$25 of the T 0.75% April 30, 2026, US Treasury 5-year note @ 100 and...

Buying a seven-year (expiration) payer swaption (put option) on \$800 of a 20yr swap (bond) at a price of 3.125% (\$800 \* 3.125% = \$25)

This option is functionally a seven-year put option on a thirty-year bond.

The table below is a **MODELED** profile of how such a strategy could perform, contingent upon a few <u>important assumptions</u> (\*), as rates vary. **This is not a prediction**, but rather a modeled pricing projection using a \$50 initial price compared to the CME listed "US" futures contract.

The -aero line- is an "instant" snapshot as rates vary and Implied Volatility is held constant The -ajax line- is the value of an unlevered short position in the CME 20yr futures contract The -begonia line- is the Strategy, two years hence, with Implied Volatility held constant The -folly line- is the value of the CME future, two years hence (rolled quarterly) The -yahoo line- is the Strategy, two years hence, with rising Implied Volatility The -anemone line- is a three times levered CME future, two years hence

	<u>-50bp</u>	Unchanged	+50bp	+100bp	+150bp	+200bp	+250bp	+300bp
	\$42.51	\$50.00	\$60.17	\$73.11	\$88.66	\$106.42	\$125.72	\$145.74
Px Difference	\$46.89 -\$4.38	\$0.00	\$52.89 \$7.28	\$55.58 \$17.53	\$30.58	\$46.02	\$63.16	\$64.58 \$81.16
	\$38.10	\$45.07	\$55.16	\$68.79	\$86.01	\$106.48	\$129.47	\$153.95
	\$45.08	\$48.20	\$51.09	\$53.77	\$56.27	\$58.60	\$60.76	\$62.78
Px Difference	-\$6.98	-\$3.13	\$4.07	\$15.02	\$29.74	\$47.88	\$68.71	\$91.17
	\$38.10	\$45.07	\$55.16	\$70.79	\$90.01	\$112.48	\$136.47	\$161.95
	\$35.26	\$44.60	\$53.27	\$61.33	\$68.83	\$75.80	\$82.29	\$88.33
Px Difference	\$2.84	\$0.47	\$1.89	\$9.46	\$21.18	\$36.68	\$54.18	\$73.62

The table above is designed to profile both the <u>modeled</u> Interest Rate sensitivity as well as the Convexity provided by this Strategy. <u>I propose the third set as the</u> <u>best apples-to-apples comparison</u> that captures its relative leverage as well as the cost of holding the position.

The Strategy's "cost" is the decay (theta) of the option; for the CME futures contract, it is the negative interest rate (carry) paid when the contract is rolled quarterly. Take special notice of the narrow difference to hold the Strategy for two years versus a levered futures position; <u>the Strategy offers substantially</u> <u>better upside with similar downside</u>.

#### Sensitivities of the Strategy

Near 2.00% on the twenty-year swap rate, similar to about 2.35% on 30-year US Treasury, **every basis point change** in yield will move the price of the Strategy by about 17.5cents. So, if the 20-year swap rate rose from 2.00% to 2.05%, the value of the Strategy might move from \$50 to \$50.88. Similarly, if the 20yr swap rate declined to 1.90%, the Strategy might decline to \$48.25.

By design the strategy is long "Vega" – its **exposure to Implied Volatility** (IVol). The fact that the value of this Strategy can increase without a change in interest rates is a feature, not a bug. Again, near 2.00% on the 20-year swap rate, a ten percent rise in the level of Volatility will increase the value of the Strategy by about \$6, or more specifically, about \$1 per normal Volatility.

The use of options, instead of futures or other risk management tools, offers the significant benefit of **positive Convexity** – also known as asymmetric leverage.

Borrowed from above, the -begonia line- is the Strategy value for each 50bp increment with <u>no change in its Implied Volatility</u>, while the -anemone line- is the same for the 3-times levered CME US futures contract. Below each is the -cymbidium line- marginal change ("delta") in price for each step, and beneath that is the -prunus line- (Convexity) change of the change ("gamma").

The Strategy and the short Futures contacts both become more profitable as rates rise as they both have negative duration – they rise as rates increase; but <u>the rate of change is different</u>. The positive -prunus line- for the Strategy is a measure of its positive convexity. In contrast, the negative prunus number for the Futures indicates negative convexity (its price rises, but at a slower pace).

	-50bp	Unchanged	+50bp	+100bp	+150bp	+200bp	+250bp	+300bp
Strategy Value	\$38.10	\$45.07	\$55.16	\$68.79	\$86.01	\$106.48	\$129.47	\$153.95
Change in Value		\$6.97	\$10.09	\$13.63	\$17.22	\$20.47	\$22.99	\$24.48
Change in Change			\$3.12	\$3.54	\$3.59	\$3.25	\$2.52	\$1.49
3x Levered Future	\$35.26	\$44.60	\$53.27	\$61.33	\$68.83	\$75.80	\$82.29	\$88.33
Change in Value		\$9.34	\$8.67	\$8.06	\$7.50	\$6.97	\$6.49	\$6.04
Change in Change			-\$0.67	-\$0.61	-\$0.56	-\$0.53	-\$0.48	-\$0.45

[Note for geeks: Fixed-income securities (bonds) are by definition positively Convex, so being short a bond (future) creates a negatively Convexity profile.]

**Special Notice:** The one caution to this Strategy is its **Liquidity**. While the OTC options market trades billions a day, the bid//offer spread for customized options can be 10bp on either side of "mid", which is where we mark the NAV of the Strategy. As such, the cost to enter the Strategy can be \$1 over its NAV; and this cost could be paid again upon a net exit from the Strategy. Thus, my strong warning to size your investment appropriately for a longer-term horizon.

# **Primary Value Propositions**

A primary input into an option price is the level of the underlying asset, and as noted the -verbena line- twenty-year swap rate is still near historic lows, and quite distant from the -zinnia line- strike price of the option.



The more important driver of option pricing is the -dianthus line- IVol; notice this vector too is a full standard deviation below its long-term average.



A most interesting observation is that -calla dot- IVol is about 10% cheap relative to the shape of the Yield Curve, a result of the FED's heavy hand.



# **Secondary Value Propositions**

While the Primary option pricing inputs of low Interest Rates and Implied Volatility may be eye candy, the Secondary considerations are the true value propositions.

Most risk vectors are <u>-gerbera line</u>-linear, so a \$2 dividend for a single year bumps along a straight line to a \$10 dividend over five years.

In contrast, option prices increase by the -catmint line- square root of time (years). Thus, a one year-option may cost \$5, a two-year option would cost \$7.07 (\$5 \* 1.41), and three-year option would cost \$8.66 (\$5 \* 1.73); all assuming a similar Implied Volatility. [SqRoot 2 = 1.41; SqRoot 3 = 1.73]



Taken to its reasonable extreme, a six-year option would cost \$12.25 while a seven-year option would cost \$13.23, a difference of 98 cents in time decay. Compare this to the \$1.59 of time decay (theta) as a three-year option bleeds into a two-year option.



This reduction in the option decay is further enhanced by the shape of the -yarrow line- Term Surface, which is inverted for interest rate options; presently the seven-year Implied Volatility is 5% lower than that of the five-year option. As such, the rising IVol somewhat offsets the "bleed" of time decay. Perhaps the most interesting Secondary Value proposition is the **relatively flat Skew** – the Implied Volatility level for options that are not at-the-money.

Most investors are familiar with the -gentians line- for options on the S&P 500. Notice the huge risk premium for out-of-the-money "tail hedges"; which is why equity disaster insurance is so expensive. In sharp contrast, the risk premium for a -dahlia line- interest rate hedge is relatively small. In a nutshell, one can buy catastrophe insurance on interest rates for only a small IVol mark-up.



# When to use this Strategy

This Strategy will hold only Treasury notes and long-dated Interest Rate options; and it will <u>not be actively managed</u> for at least the first few years, unless interest rates jump dramatically in the near-term. As such, its performance profile can be reasonably and consistently modeled relative to interest rates.

While I will not stop anyone from using this Strategy for speculation, it has been designed as a "set it and forget it" hedge to mitigate the wide variety of risks attendant to rising interest rates.

I cannot offer investment advice, and I will say there is no single "right answer" for how to properly size the Strategy, but if I must offer a 30,000 foot comment, I would suggest that \$50,000 of the Strategy would pair nicely with a \$1,000,000 intermediate-term bond portfolio.

Using the back of an envelope, over the <u>first two years in an unchanged</u> <u>environment</u>, the Strategy value declines from \$50.00 to \$45.07; on a \$50,000 investment that is \$4930 or roughly 25 basis point per year spread over \$1mm.

This is NOT a dollar-for-dollar hedge, but it will cushion your risk exposure.

#### **Modeled Risk Profiles**

Let's start with an easy example. The -brunnera line- is the varying price of a typical <u>investment grade BBB-rated bond</u> issued in 2007 with 17 years remaining.

The -hellebores line- is the total return profile for a portfolio that consists of only \$1mm (face) of this security with a current value of \$1,365,700 which is priced at 120bp above the US Treasury 20-year bond.

The -ranunculus line- includes \$50,000 of the Strategy which is proportional to the <u>original face amount</u> of the investment, and the -cockscomb line- includes \$75,000 of the Strategy, which is closer to its <u>current market value</u>.

ATT 6.30% 1	1/15/2038 (Cus	ip 00206RAG	7)				
-50bp	Unchanged	+50bp	+100bp	+150bp	+200bp	+250bp	+300bp
145.92	136.57	130.31	122.22	115.78	109.78	104.19	98.97
2.90%	3.40%	3.90%	4.40%	4.90%	5.40%	5.90%	6.40%
Two year Tot	al Return (price	change + cou	upon annualized	d)			
5.97%	3.37%	0.94%	-1.34%	-3.47%	-5.48%	-7.36%	-9.12%
\$163,000	\$92,100	\$25,700	-\$36,500	-\$94,900	-\$149,600	-\$201,000	-\$249,200
Two year Tot	al Return with	\$50,000 Strat	egy hedge (pric	e change + cou	pon annualized)		
5.34%	3.08%	1.09%	-0.55%	-1.94%	-3.08%	-4.04%	-4.85%
\$151,100	\$87,170	\$30,860	-\$15,710	-\$54,890	-\$87,120	-\$114,530	-\$137,250
Two year Tot	al Return with	\$75,000 Strat	egy hedge (pric	e change + cou	pon annualized)		
5.04%	2.94%	1.16%	-0.18%	-1.21%	-1.94%	-2.47%	-2.82%
\$145,151	\$84,706	\$33,441	-\$5,314	-\$34,884	-\$55,879	-\$71,294	-\$81,274

While I cannot stress enough that this is a static modeling of parallel shifts with many assumptions, it does properly capture the rough justice of this strategy.

Vastly more interesting is using the Strategy to <u>hedge a callable Municipal bond</u> with a 4.00% coupon, which lines up nicely with the 4.25% strike of the option. Recall that the owner of a callable bond is short an option struck at the coupon, as such, this particular bond may mature in four years at current rates, but extend to a much longer (and riskier) 24 years if rates rise.

CA 4.00% 11	/01/2045 (Cusip	= 13063DVZ8	8)				
-50bp	Unchanged	+50bp	+100bp	+150bp	+200bp	+250bp	+300bp
116.33	113.21	109.67	105.614	101.014	95.955	90.605	85.162
Two year To	tal Return (price	change + cou	ipon annualized	d)			
1.27%	1.31%	0.53%	-0.52%	-2.09%	-4.02%	-6.19%	-8.48%
\$28,801	\$29,590	\$12,090	-\$11,800	-\$47,400	-\$91,000	-\$140,150	-\$192,000
Two year To	tal Return with	\$60,000 Strate	egy hedge (pric	e change + cou	pon annualized	)	
0.61%	0.99%	0.77%	0.55%	0.03%	-0.67%	-1.53%	-2.42%
\$14,522	\$23,675	\$18,283	\$13,149	\$613	-\$16,023	-\$36,385	-\$57,659

# Hedging a Home Mortgage

Assume one took out a 5-1 ARM three years ago (an Adjustable-Rate Mortgage with a fixed five-year rate that adjusts to current levels after five years), that resets in two years.

\$1mm loan amount Current Rate = 2.50%; Monthly payment = \$3951.

Rates rise 200bps in two years to reset at 4.50%; Monthly payment = \$5067Over the next five years, the additional cost is \$66,960 [(\$5067 - \$3,951) \* 60]

If \$50,000 is invested in the strategy, and rates rise 200bp as per our Modeled Profile (with no change in Implied Volatility) over two years:

The strategy gains \$56,480 (\$106.48 - \$50 times 1000), which mostly offsets the \$66,960 increase in the five year cost of the mortgage.

If Rates are unchanged: A loss of \$4,930 is incurred (\$45.07 - \$50 times 1000)

If Rates are lower: A lower mortgage rate offsets some of the Strategy loss.

# Managing a mid-size Multi-Family Construction Project

The demographic rubber has finally met the road as two of my four Millennial kids are engaged and will soon be looking for permanent housing.

More likely for many, your kid who has been living in the basement playing video games (unwashed with a mouthful of Cheetos) has been hired by Palantir to code an anti-ransomware defense and wants to (finally) move out to a new place with over 500Mbps of internet gaming speed.

Such a pity there is a massive housing shortage; so, you decide to profit by building a speculative Multi-Family project. After the permits have been approved, and the construction loan secured, the remaining financial risk is guessing the rate level for the permanent financing at the end of the project which will not only drive your cashflow projections, but also impact the Cap Rate to value the project if sold upon completion.

Unless you are a large-scale construction firm with strong ties to Wall Street investment banks, it is unlikely you will have access to professional hedging strategies. I will leave it to you to place pencil to paper for how to size this Strategy.

#### Comments and Cautions...

I had no greater pleasure on Wall Street than tangling with Rosie (David Rosenberg; *twitter @EconguyRosie*) at the Tuesday morning trader's meeting.

Rosie was shown the door after pounding the table a bit too hard about the impeding sub-prime crisis, which was in direct conflict with senior management's (successful) effort to load the firm's books with \$45 billion of such crap.

As such, I will stipulate that David will be more right than wrong; and note that he does NOT subscribe to the notion of inflation nor higher interest rates.

But...there is the chance he is wrong, and rates do increase. Pundits propose that the FED cannot let rates rise because of the damaging effect on the economy; but just as the 11<sup>th</sup> century King Canute highlighted the futility of "trying to stop the tide", I too wonder how the Trillions of (toothpaste) money created over the past decade can be shoved back into tube without inflation.

Even our greatest bond bull, Lacy Hunt at Hoisington (<u>https://hoisington.com</u>), admits that direct monetization by the FED could change his view.

This is why I have personally invested in various forms of this Strategy. It is <u>unknown</u> if interest rates will increase, but I do <u>know</u> that if they do rise much past 4.25% there will be a series of unfortunate financial events.

As noted, one could "trade" this Strategy, but it is designed to be held for a longer horizon. Via its significant positive Convexity, its gains can exceed its limited loss; but **it will be quite volatile** as it is super sensitive to interest rates and Implied Volatility.

While the underlying OTC (over-the-counter) interest rate options accessed via the Strategy are deep and liquid, this is a relative term; these are NOT listed options that are visible and traded on an exchange. That said, <u>the risk profile</u> they offer cannot be duplicated elsewhere.

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

Harley S. Bassman June 8, 2021

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# (\*) Assumptions for a MODELED Performance Profile

Any (modeled) projected performance profile requires a few assumptions, and there is myriad more for long-dated options. As a 35-year Wall Street professional, I am well aware of how to slant a profile with "tricks"; but I believe the assumptions used here are both reasonable and conservative.

- 1) Excluded are all fees, commissions, and transaction costs.
- 2) I assume the initial portfolio ratio is fixed, with no adjustments.
- 3) I use Wall Street standard (Bloomberg) instant "parallel shifts"; this is conservative since long-term rates will likely rise more than FED controlled short-term rates.
- 4) All prices calculated on Bloomberg SWPM or BC1.
- 5) I assume "roll down" for USTs
- 6) I assume no "roll down" for the cheapest to deliver.
- 7) I use mid-market pricing for all risk vectors.
- 8) Excluded is the interest income of the UST allocation.
- 9) I assume the spread between USTreasuries constant versus Swap rates.
- 10) I hold Implied Volatility flat in the base case at 76nv
- 11) I assume Implied Volatility does not rise until rates increase by 100bps in the rising Vol profile, and then by 3nv per 50bp shift.
- 12) Implied Volatility for the "2yr hence" case rides the current term surface, presently 5yr options are about 4nv higher than 7yr options.
- 13) I assume the cost of rolling the US futures contract is unchanged for all eight rolls.
- 14) I assume there is no delivery shift in the futures contract.
- 15) I assume no slippage in managing the Strategy over time.
- 16) I assume a "buy and hold" from issuance.





Your comments are always welcome at: <u>harley@bassman.net</u>

If you would like to be added to my distribution, just ping me. 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

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