



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

QUANTITATIVE INVESTMENT MANAGEMENT

LECTURE 30

Fixed Income Portfolio Strategies - 2

J P Singh

Department of Management Studies



USE A CARRY TRADE

- A carry trade is just another form of leverage.
- Return is enhanced by borrowing at a lower rate to invest the funds in an asset that will generate a higher rate of return.
- In a stable upward sloping curve, borrow at lower shorter-term rates to invest at higher longer-term rates.



SELL CONVEXITY

- This means select bonds or a portfolio with lower convexity.
- By itself, positive convexity (+C) is beneficial.
- It means that if there is a large decline in interest rates, the increase in the bond's price will be greater than expected from duration alone.
- Or if there is large increase in interest rates, the decrease in the bond's price will be less than expected from duration alone.
- Thus, +C magnifies the upside and reduces the downside of price movement due to changes in rates.

- The changes in rates have to be rather large because convexity is a second order impact on price.
- That means $+C$ has little impact on change in price unless the rate change is significant.
- Of course there is rarely any free lunch.
- Bonds or portfolios with higher $+C$ normally have less yield.

- The conclusion is that if the curve is expected to be stable (little change in rates), there will be minimal or no benefit from +C and the lower yield will reduce return.
- Thus, it is better to “sell convexity” (reduce convexity) to receive higher yield and expected return.

STRATEGIES FOR PARALLEL SHIFT IN YIELD CURVE



ADJUST DURATION

- A parallel shift in the curve portfolios with the same duration are expected to have the same percentage change in value. $\frac{dP}{P} = -D \frac{dy}{1+y} +$

$$C \left(\frac{dy}{1+y} \right)^2 .$$

- If rates are expected to increase, decrease portfolio duration before this occurs to minimize the value lost.
- If rates are expected to decrease, increase portfolio duration before this occurs to maximize the value gained.
- Of course all changes in duration must be consistent with the portfolio constraints.

ADJUST CONVEXITY

- **Greater convexity will:**
- **Increase the value gained if rates decrease.**
- **Decrease the value lost if rates increase.**
- **The convexity effect will only be material if the rate change is significant and it will involve accepting less yield (assuming rational pricing of assets in the market).**



STRATEGIES FOR NON-PARALLEL SHIFT IN YIELD CURVE



ADJUST EXPOSURES

- The basic concept is simple.
- First, determine the appropriate duration for the portfolio.
- Within that constraint of meeting target total duration:
- Increase exposure to those points on the curve where rates are expected to show a relative decrease in level.
- Decrease exposure to those points on the curve where rates are expected to show a relative increase in level.

IMPLEMENTATION: BULLET VS BARBELL

- The simplest way to implement this strategy is selection of a bullet versus barbell portfolio.
- The bullet portfolio concentrates exposure in the desired total portfolio duration point of the curve (denoted here as M for middle).
- The barbell portfolio concentrates exposure at shorter and longer points of the curve to achieve the same desired total portfolio duration.
- A ladder portfolio would distribute exposure more evenly along the curve between L and H .



LADDERED PORTFOLIO

- In a laddered portfolio, roughly equal par amounts are purchased, and become due each year.
- The same duration could also be achieved by concentrating all the holdings in a single middle duration (a bullet portfolio) or in a shorter and longer duration (a barbell portfolio).
- If all three portfolios have the same duration, they all have roughly the same price sensitivity to a parallel yield curve shift.

- With a laddered portfolio, the investor is diversified between price and reinvestment risk. Some bonds mature each year and can be reinvested if rates are high. This creates a form of dollar cost averaging over time. The ladder has less reinvestment risk in any single year versus the barbell (or bullet).
- The more distributed cash flows of the ladder compared to the bullet will provide greater convexity—benefitting performance for large changes in rates.

ADVANTAGES OF LADDERED PORTFOLIO

- The greatest practical advantage is natural liquidity, as some bonds come due each year.
- This is particularly significant if less liquid bonds such as corporates are used.
- The need to sell at large bid-ask spread to meet cash flow need is reduced.
- Alternatively, these now near-to-maturity bonds would be treated as less risky collateral and could be used to borrow at favorable interest rates.

- **There is the broadest diversification of cash flow across time and the yield curve —hence, less concentrated exposure to twists in specific points on the curve.**
- **In an upward sloping yield curve, this can also be desirable as each maturing bond is rolled over into the longest (and highest yielding) maturity used in the ladder.**

- **There is diversification between price and reinvestment risk.**
- **Regarding price risk, some bonds mature each year (see natural liquidity).**
- **Regarding reinvestment risk, some bonds mature each year, so some proceeds will be reinvested at higher and some at lower rates. This creates a form of dollar cost averaging.**

- The laddered portfolio will have more convexity than the bullet, a benefit if there are large parallel shifts.
- Further the ladder will have lesser convexity than the barbell. Recall that that distribution of cash flows is directly related to convexity.
- The duration contributions and key rate durations of the bullet, ladder, and barbell will also differ. So, the portfolios will respond differently to nonparallel twists in the curve. The ladder will typically fall in the middle of such curve risk exposure.

EXAMPLE: SELECTION OF CURVE STRATEGY

- Consider a portfolio with a benchmark that is laddered and has a duration of 10. The manager is considering three possible strategies:
- **Bullet:** 100% in securities with a duration of 10. The yield and convexity are 4.51% and 16.4 respectively.
- **Barbell:** 50% in securities with a duration of 2 and 50% in securities with a duration of 18, for portfolio duration of 10. The yield and convexity are 4.30% and 24.7 respectively.
- **Ladder:** Match the benchmark which has an equal distribution of 1 to 19 duration bonds for portfolio duration of 10. The yield and convexity are 4.39% and 20.1 respectively.

A. OPTIMAL STRATEGY FOR A SMALL AND VERY NEAR TERM PARALLEL UPWARD SHIFT IN THE YIELD CURVE.

- There is no distinct advantage for any strategy. They all have the same duration and expected change in value for a parallel shift.**
- The bullet has a yield advantage, but over a short time period that will not matter much.**
- The barbell has more convexity but for a small change in rates that will not matter much.**
- The ladder more closely matches the portfolio benchmark's duration distribution but has no material expected return advantage in this scenario.**

OPTIMAL STRATEGY FOR A LARGE PARALLEL AND VERY NEAR TERM UPWARD SHIFT IN THE YIELD CURVE.

- **The barbell.**
- With a large increase in interest rates, the higher convexity of the barbell will produce the greatest cushioning of price decline.

OPTIMAL STRATEGY FOR A LARGE PARALLEL DOWNWARD SHIFT IN THE YIELD CURVE OVER THE NEXT 12 MONTHS.

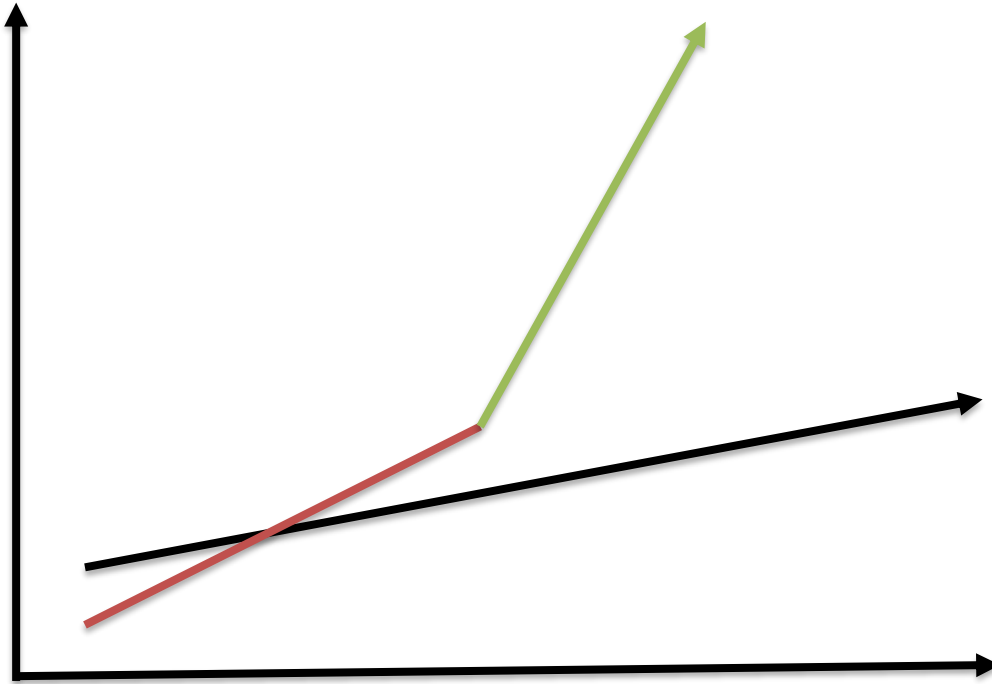
- There is no distinct advantage for any strategy. There are conflicting issues. They all have the same duration.**
- The bullet has a yield advantage over the next 12 months.**
- The barbell has more convexity which will increase its value gain for a large decrease in rates.**
- The ladder more closely matches the portfolio benchmark's duration distribution but has no material expected return advantage in this scenario.**

D. OPTIMAL STRATEGY FOR AN IMMEDIATE STEEPENING OF THE CURVE WITH SHORT RATES (DURATION OF 1) DECREASING 50 BP, NO CHANGE IN INTERMEDIATE RATES (DURATION OF 10), AND LONG RATES (DURATION OF 19) INCREASING 50 BP.

- **The bullet is best.** With no change in intermediate rates, it will not decline in value. The others will decline in price.
- The manager has described a pivot in the curve. With long rates up 50 bp and high duration there will be a large decline in value. The 50 bp decrease in shorter rates with less duration will not produce as large a value gain.
- Thus the barbell will decline the most and the ladder will decline some.

E. STATE THE OPTIMAL STRATEGY IF THE MANAGER EXPECTS AN IMMEDIATE STEEPENING OF THE CURVE WITH SHORT RATES (DURATION OF 1) DECREASING 10 BP, INTERMEDIATE RATES (DURATION OF 10) INCREASING 40 BP, AND LONG RATES (DURATION OF 19) INCREASING 90 BP.

- **The bullet is best for the same reasons as in previous case.**
- **There is a steepening and that favors the bullet.**
- **There are also elements of a parallel upward shift, but all strategies have the same duration and respond the same to a parallel shift, ignoring the small convexity effect.**



F. OPTIMAL STRATEGY FOR IMMEDIATE FLATTENING OF THE CURVE WITH SHORT RATES INCREASING 50 BP, NO CHANGE IN INTERMEDIATE RATES, AND LONG RATES DECREASING 50 BP.

- The barbell because it has the most exposure to long duration assets where rates will decrease. This will give it the largest value gain.**

CONVEXITY ISSUES



IMPACT OF CONVEXITY

- All else being the same, it is beneficial to have greater convexity when large changes in rates are expected.
- The convexity will magnify value gain when rates decrease and cushion price loss when rates increase.
- However, there is likely to be a cost in the form of lower yield (and income from the portfolio).

INCREASING CONVEXITY



METHOD 1: BARBELL VS BULLET

- To increase convexity, the more distributed future cash flows of a barbell will have higher convexity, but lower yield.
- To decrease convexity, the more concentrated future cash flows of a bullet will have lower convexity, but higher yield.
- Generally, shifting between barbell and bullet structures has only a modest impact on convexity, holding total duration the same.
- Options have a much more dramatic impact on convexity.

METHOD 2: OPTIONS ON BONDS

- Please note that we are NOT talking about embedded issuer call options that exist in callable bonds. We are considering portfolios of bonds together with calls written on them.
- Long call options on bonds (or on bond futures contracts) increase in value as the underlying increases.
- Thus they provide increased upside for portfolio value as bond prices increase and rates decline.
- More upside means more positive convexity.

- **Long put options on bonds (or on bond futures contracts) increase in value as the underlying decreases. Thus they reduce the downside as bond prices decline and rates increase. Less downside means more positive convexity.**

- **Buy call and/or put options to increase convexity. The premiums paid to buy the options effectively reduce the yield earned on the portfolio.**
- **Sell call and/or put options to decrease convexity. The premiums received from selling the options effectively increases the yield earned on the portfolio.**
- **Many portfolios have constraints that restrict the use of options.**

METHOD 3: BONDS WITH EMBEDDED OPTIONS

CALLABLE BONDS

- Callable bonds can be decomposed as an option-free bond and a short call position on the underlying bond.
- If rates decline the issuer's right to call the bond increases in value and the price upside of the bond is limited.
- Thus the callable bond has diminished in value and hence has negative convexity (at lower rates) compared to an otherwise equivalent option-free bond.
- Callable bonds have a higher yield than an equivalent option-free bond.

PUTTABLE BONDS

- Puttable bonds can be decomposed as an option-free bond and a long put position on the underlying bond.
- If rates increase, the owner of the bond can put the bond to the issuer.
- The owner's right to put the bond increases in value and reduces the price downside of the bond as rates increase.
- Thus the puttable bond has increased positive convexity (at higher rates) compared to an otherwise equivalent option-free bond.
- Puttable bonds have lower yield than an equivalent option-free bond.

SUMMARY:

INCREASING CONVEXITY WITH OPTION BONDS

- **Decrease holdings of callable bonds and/or increase holdings of puttable bonds to increase convexity (and decrease yield).**
- **Increase holdings of callable bonds and/or decrease holdings of puttable bonds to decrease convexity (and increase yield).**