Federal Home Loan Bank Seattle

Understanding Balance Sheet Option Risks and Returns

A Seattle Bank Web Seminar

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Federal Home Loan Bank Seattle

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Goals of this Presentation

- Identify where banks find optionality in their balance sheet, and how it impacts financial performance
- Explain the difference between being “long” (buying) and being “short” (selling) optionality
- Clarify what option risk is, and what “bet” is being made when banks take it
- Explore how options are priced and how they behave
- Define when banks should TAKE option risk and when they should REDUCE it
- Examine how interest rate caps and floors reduce option risk
- Review examples of how banks can embed caps and floors and borrowings to help manage risk

What risks do banks take in their balance sheets?

- **Credit Risk**
  - Risk that debtors default on loans, costing the bank money
  - Found in loans and non-government securities
- **Liquidity Risk**
  - Risk that bank will not be able to raise cash to meet its obligations or fund loan growth
  - Includes risk that assets cannot be sold in an orderly market due to lack of buyers
- **Interest Rate Risk**
  - Risk that movements in interest rates will squeeze margins due to mismatch between asset and liability repricing
  - Often referred to as “duration risk”
- **Optionality**
  - Risk that cash flow occurs sooner or later than expected because of option granted to counterparty
  - Often referred to as “negative convexity”

The “long” and “short” of optionality:

- You are “SHORT” (have sold) optionality if your counterparty has the right to exercise the option, which will hurt you.
- You are “LONG” (have bought) optionality if YOU have the right to exercise the option, which will hurt your counterparty.

- *Most banks are exclusively SHORT options, for these reasons:*
  - They don’t have a choice (with customers, loans).
  - They get paid more in yield for selling optionality in securities.
  - They pay less for funding with embedded call options.
  - BUYING options is expensive!!!

Where do banks have “short” option positions?

- **Residential Mortgages**
  - Borrowers can prepay mortgages at any time.
  - Prepayments accelerate as rates fall, forcing the bank to re-lend at lower rates.
  - Prepayments slow as rates rise, reducing cash flow to re-lend at higher rates.
- **Investment Portfolio**
  - Callable agency bonds will get called if rates drop, and reinvested at lower yields.
  - Mortgage-backed securities have same prepayment risk as mortgage loans.
- **Wholesale Funding**
  - Use of putable / convertible borrowings has exploded in last 10 years.
  - These are cancelled / converted as rates rise, forcing bank to refinance borrowing at higher rate.
- **Customer Deposits**
  - Depositors tend to migrate to shorter deposits when rates are rising, and to longer deposits when rates are falling.
  - This form of option risk is often ignored, at bankers’ peril.

Where do banks have “long” option positions?

- **Floors in Prime-based Loans**
  - Prevents the rate on the loan from falling below some minimum level if the Fed is easing and Prime is dropping
  - Have become more popular in the last five years due to Fed taking rates much lower than in 2001-2003
- **Callable CDs**
  - Can be cancelled by the bank at specified time
  - Allows the bank to cancel and replace funding at lower rates if rates fall
  - More often done in brokered market (banks are reluctant to cancel CDs with their own customers)
- **Purchased Caps and Floors**
  - Insurance contracts that protect the bank from rising or falling rates
  - Done both outright as derivatives, as well as embedded in borrowings
  - Use has grown dramatically in last 10 years
- **Putable Bonds and Callable Borrowings**
  - Allow the bank to cancel the instrument and reinvest at higher rate (bonds) or re-borrow at lower rate (borrowings)
  - Rarely used due to perceived high cost of buying the option

Looking at the entire balance sheet

These are very typical interest rate risk profiles for banks…

Asset-Sensitive Bank

Rate Shock	Net Int Income	$ Change From Base	$ Change From Base
-2%	9,500	-500	-5%
Flat	10,000	0	0%
+2%	10,200	200	2%

Liability-Sensitive Bank

Rate Shock	Net Int Income	$ Change From Base	$ Change From Base
-2%	10,300	300	3%
Flat	10,000	0	0%
+2%	9,300	-700	-7%

- Note that in BOTH cases, the results are not “symmetrical.”
- The loss of income in the “bad” rate environment is worse than the gain in income in the “good” environment.
- The chief culprit for this is the bank being short optionality.
- For example: Liability sensitive bank may not benefit as much if rates fall because mortgage assets prepay.

Placing your bets

Banks "bet" on interest rates EVERY DAY!

Blasphemy?

Consider the following: Your bank has cash to invest in the bond portfolio and is considering the following agency securities…

Current Yields

1 Year	2.83%
4 Year	3.92%
5 Year	4.30%
5nc1*	4.45%

** One-time call*

What is the bet when you pick a bond?

1 Year Bond: Bet that in a year, you can reinvest for 4 years at a total 5-year yield of > 4.30%

4 Year Bond: Bet that in 4 years, you can reinvest for one year at a total 5-year yield of > 4.30%

5 Year Bond: Bet that shorter-term rates won't go up enough to make investing short-term yield more than 4.30% a year for 5 years

What bet does the callable bond place?

Examining the option-risk "bet"

- Let's invest in the 5nc1 at 4.45%, and see how we do versus two other alternatives in different rate environments.
- For this exercise, we are assuming an immediate rate shock, and that as the bond is called or matures, we reinvest into the same bond adjusted for rate shock.

Shock	Bond	Year 1	Year 2	Year 3	Year 4	Year 5	Average	Called?
Flat	Callable	4.45%	4.45%	4.45%	4.45%	4.45%	***4.45%***	TRUE
	1 Year	2.83%	2.83%	2.83%	2.83%	2.83%	2.83%	
	5 Year	4.30%	4.30%	4.30%	4.30%	4.30%	4.30%	

Shock	Bond	Year 1	Year 2	Year 3	Year 4	Year 5	Average	Called?
-2.00%	Callable	4.45%	2.45%	2.45%	2.45%	2.45%	2.85%	TRUE
	1 Year	2.83%	0.83%	0.83%	0.83%	0.83%	1.23%	
	5 Year	4.30%	4.30%	4.30%	4.30%	4.30%	***4.30%***	

Shock	Bond	Year 1	Year 2	Year 3	Year 4	Year 5	Average	Called?
3.00%	Callable	4.45%	4.45%	4.45%	4.45%	4.45%	4.45%	FALSE
	1 Year	2.83%	5.83%	5.83%	5.83%	5.83%	***5.23%***	
	5 Year	4.30%	4.30%	4.30%	4.30%	4.30%	4.30%	

Notice that we only "win" with the callable security if rates are flat. Let's examine this further.

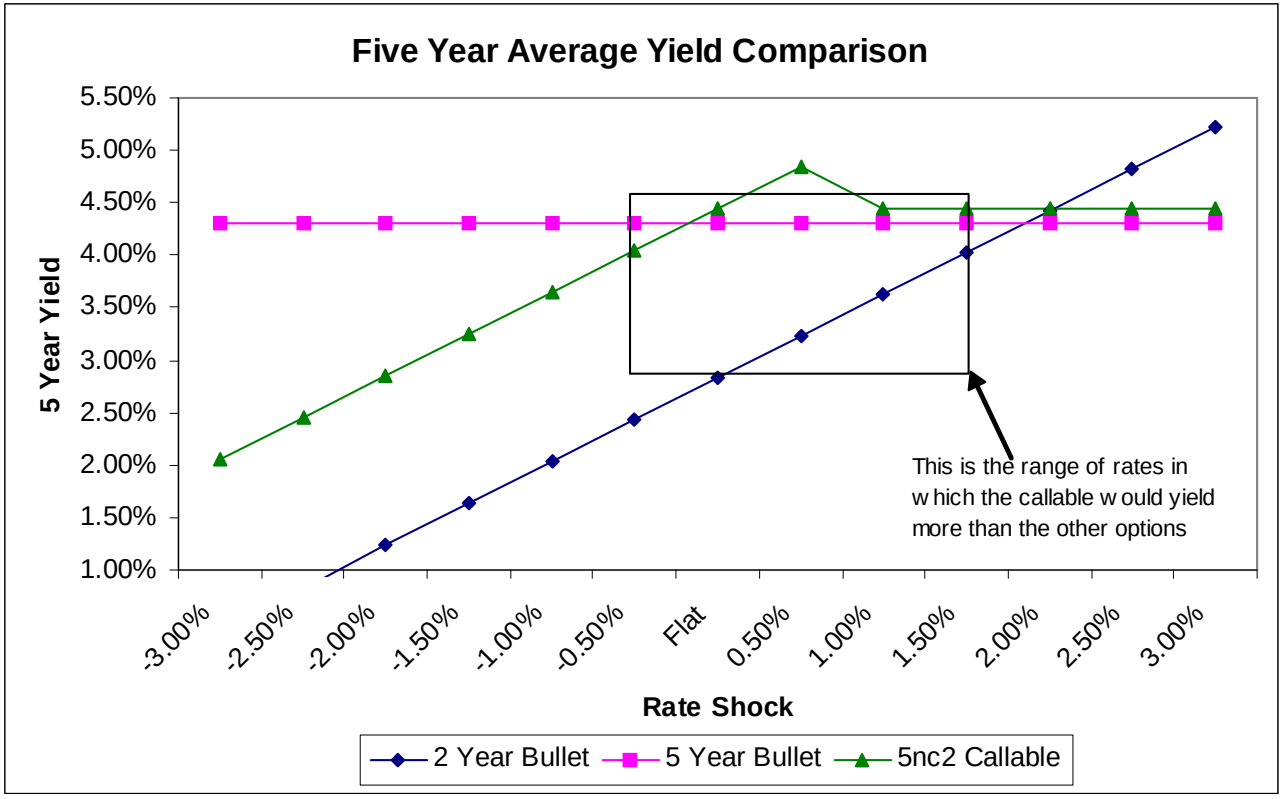
So what exactly IS the bet when taking option risk?

Five-Year Average Yield

Shock	Callable	1 Year	5 Year	Winner
-3.00%	2.05%	0.43%	4.30%	5 Year
-2.50%	2.45%	0.83%	4.30%	5 Year
-2.00%	2.85%	1.23%	4.30%	5 Year
-1.50%	3.25%	1.63%	4.30%	5 Year
-1.00%	3.65%	2.03%	4.30%	5 Year
-0.50%	4.05%	2.43%	4.30%	5 Year
Flat	4.45%	2.83%	4.30%	Callable
0.50%	4.85%	3.23%	4.30%	Callable
1.00%	4.45%	3.63%	4.30%	Callable
1.50%	4.45%	4.03%	4.30%	Callable
2.00%	4.45%	4.43%	4.30%	Callable
2.50%	4.45%	4.83%	4.30%	1 Year
3.00%	4.45%	5.23%	4.30%	1 Year

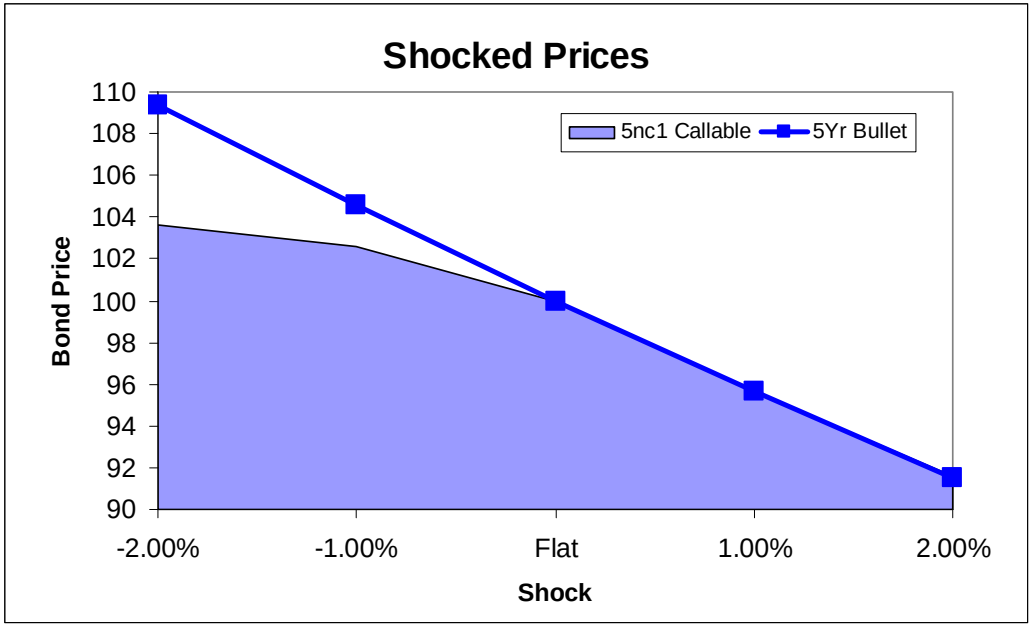
- Notice that if rates don't move much, the callable bond outperforms the other alternative.
- However, for bigger rate changes in EITHER direction, you would have been better off not taking the option risk.

A picture paints a thousand words



CONCLUSION: When you take option risk, you are betting that rates will stay in a fairly narrow range over the life of the instrument.

Optionality also impacts market values as rates move…



- When rates rise, the callable agency loses every bit as much value as the bullet agency
- However, when rates fall, the callable agency does not increase in value any where near as much, because the value of the call option moves against you
- In effect, when rates fall, the callable looks more like a 1-year bond (since it will get called), and 1-year bonds don't change in price as much as 5-year bonds

What drives option pricing?

- **Time**
  - The longer the timeframe during which the option exists, the more expensive it is (the more you get paid to sell it).
- **Exercise Price**
  - The less rates have to move before it makes sense for the option to be exercised, the more you pay for it.
  - “In the money” – Option is worth exercising based on current rates.
  - “Out of the money” – Rates need to move before option is worth exercising.
  - “At the money” – Option holder is indifferent about exercising or not.
- **Option Type**
  - One-time (“European”) exercise more expensive than continuous / periodic “Bermudan” exercise since Bermudan option is really multiple options.
- **Volatility**
  - Measures the level of market uncertainty about the future direction of interest rates.
  - The less sure we are (high volatility), the more expensive the option.

When to consider taking or reducing option risk:

- **SELLING** options typically increases current income while possibly reducing future income.
- **BUYING** options typically reduces current income while possibly increasing future income.
- There is nothing inherently "bad" about taking option risk – it is simply one type of risk that can pay the bank additional income.

- **SELL options (take option risk) when:**
  - You have a relatively neutral interest rate risk profile and, thus, can absorb the risk associated with the options.
  - You believe interest rates will remain stable, and thus, selling the options will lead to outperforming other alternatives.
  - Interest rate volatility is very high, and so you are getting paid more than you normally would for those options.

- **BUY options (reduce option risk) when:**
  - You need to reduce interest rate risk without giving up upside potential.
  - You wish to reduce the optionality that exists in the balance sheet.
  - Interest rates are either at a low- or high-point in the cycle, so that the options are very likely to work in your favor.
  - Interest rate volatility is very low, making it cheaper than normal to buy options.

Optionality comes from “Embedded Derivatives.”

- The optionality in bank balance sheets comes mostly from derivatives (yup – really) embedded in financial instruments.
- These are the most common places where you will find embedded derivatives.

Financial Instrument	Type of Derivative	When Exercised	Long / Short
Callable agency	Call option (swaption)	Rates fall	Short
Mortgages / MBS	Prepayment option	Rates fall	Short
Adjustable-Rate Mortgage / MBS	Cap(s)	Rates Rise	Short
Putable/Convertible Borrowing	Put option (swaption)	Rates rise	Short
Capped borrowing	Cap	Rates Rise	Long
Callable borrowing	Call option	Rates fall	Long
Prime-based loans with floors	Floor	Rates fall	Long

Let’s talk a little bit more about caps & floors, OK?

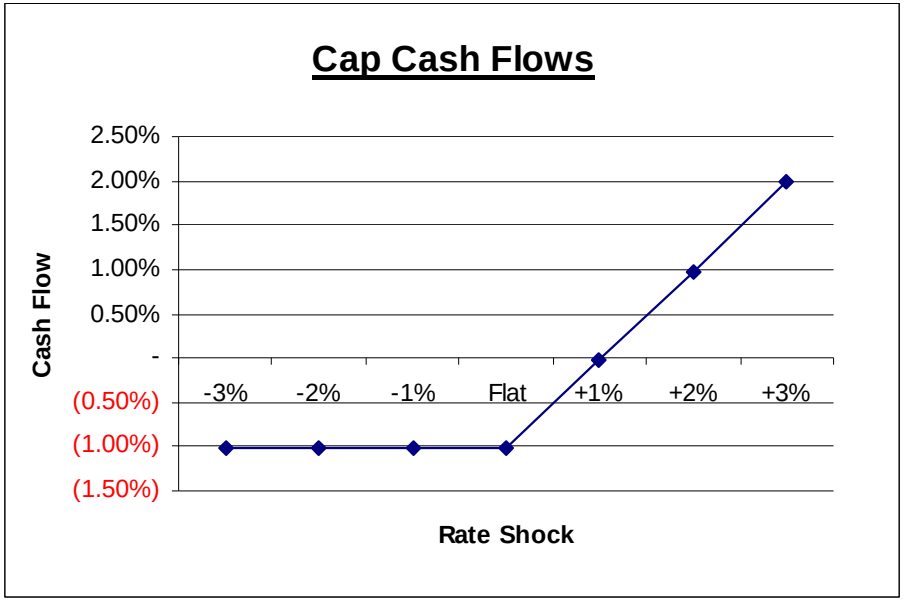
How caps work:

Let's look at a 3-year, at-the-money LIBOR cap:

- Strike rate = 2.79% (If LIBOR goes above that, cap pays the difference.)
- Up-front cost =2.87% x notional amount
- Annualized cost = 1.02% x notional amount

CASH FLOWS

Shock	LIBOR	Cost	Payment	Net
-3%	-0.21%	(1.02%)	-	(1.02%)
-2%	0.79%	(1.02%)	-	(1.02%)
-1%	1.79%	(1.02%)	-	(1.02%)
Flat	2.79%	(1.02%)	-	(1.02%)
+1%	3.79%	(1.02%)	1.00%	(0.02%)
+2%	4.79%	(1.02%)	2.00%	0.98%
+3%	5.79%	(1.02%)	3.00%	1.98%



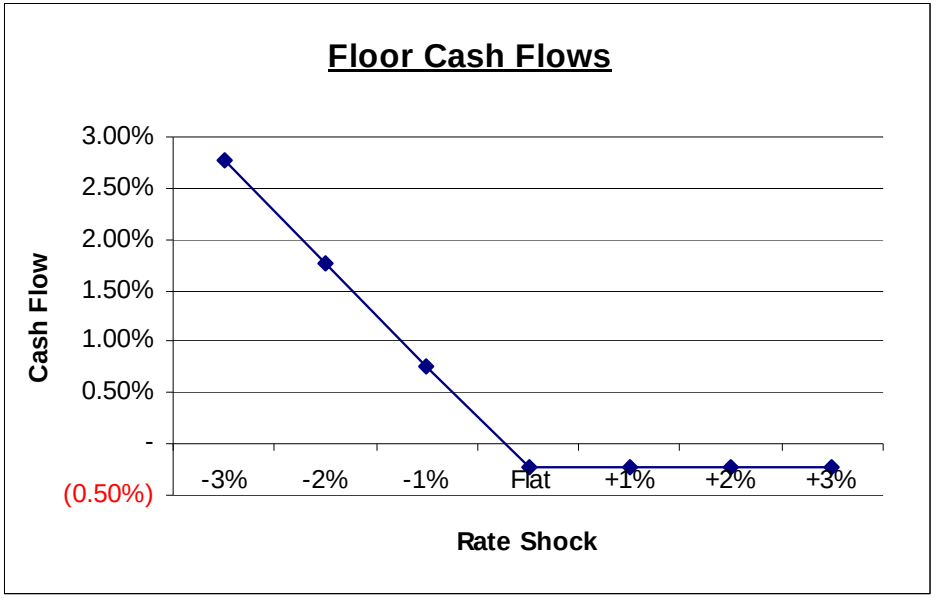
How floors work:

Let's look at a 3-year, at-the-money LIBOR floor:

- Strike rate = 2.79% (If LIBOR goes below that, floor pays the difference.)
- Up-front cost = 0.65% x notional amount
- Annualized cost = 0.23%

CASH FLOWS

Shock	LIBOR	Cost	Payment	Net
-3%	-0.21%	(0.23%)	3.00%	2.77%
-2%	0.79%	(0.23%)	2.00%	1.77%
-1%	1.79%	(0.23%)	1.00%	0.77%
Flat	2.79%	(0.23%)	-	(0.23%)
+1%	3.79%	(0.23%)	-	(0.23%)
+2%	4.79%	(0.23%)	-	(0.23%)
+3%	5.79%	(0.23%)	-	(0.23%)



Using Caps/Floors: Defense vs. Offense

Mode	Risk Position	Strategy	Impact
Defense	Asset-Sensitive	Buy floors	Replaces lost margin when rates fall
Defense	Liability-Sensitive	Buy caps	Replaces lost margin when rates rise
Offense	Asset-Sensitive	Sell caps	Increases current margin by giving up benefit if rates rise
Offense	Liability-Sensitive	Sell floors	Increases current margin by giving up benefit if rates fall

FAS133 Accounting for Derivatives

- Default = Mark-to-market via income statement:
  - Creates income statement volatility
  - Potential P&L timing mismatch (may not get it when you want it)
  - Does not flow through NIM
- Loopholes exist for “hedge accounting.”
- “Shortcut” treatment now virtually impossible to get.
- “Hassle factor” of applying hedge accounting.
- Reputation risk for public companies when hedge designation goes awry.

A better approach: Embed the caps/floors in funding!

- Determine which derivative strategy / product you would like to use:
  - Cap/Floor? Long/Short? Maturity / Strike Rate?
- "Embed" that cap or floor into a borrowing.
- There are very straightforward accounting rules that govern how this can be done – biggest issue is avoiding a negative interest rate.
- You can embed more than one cap/floor in a borrowing, as long as it passes the accounting rules.
- Cash flow on the borrowing will consist of:
  - Underlying interest rate on "host" borrowing
  - Amortized cost of cap / floor
  - Cash flows to / from the cap/floor if it's in-the-money

THIS IS NOT DIFFICULT !!!!!

Playing defense when liability-sensitive…

FIXED RATE FUNDING WITH EMBEDDED LONG CAP(S)

INPUTS

Option Type (**C**ap/**F**loor)	C	(Cap)
3 Month LIBOR	2.79%	
F**L**oating / Fi**X**ed Funding?	X	(Fixed)
Strike Rate	2.79%	
Maturity (Years)	3	
Up-Front Cost	2.87%	
Total # Caps Used	1	
Fixed Rate Funding - 3 Years	3.78%	

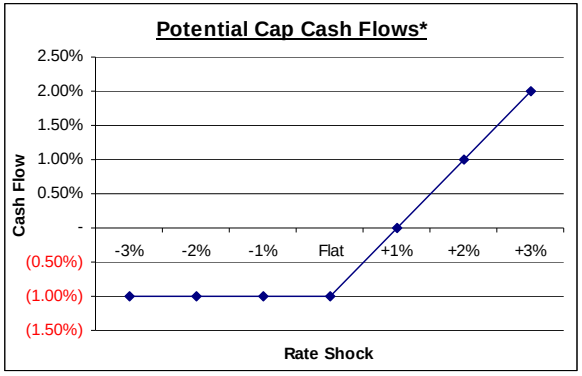
CALCULATIONS

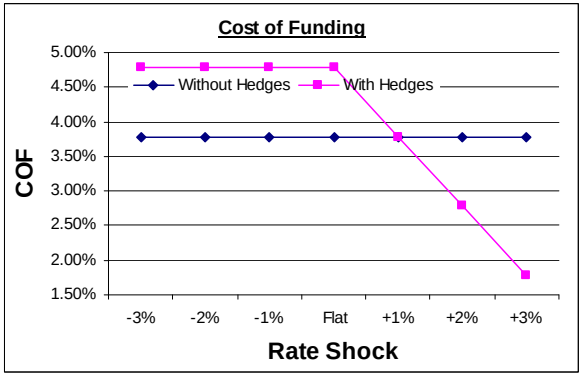
Option Duration (years)	2.86
Annual Option Cost (1 Cap)	1.00%
Annual Option Cost (Total)	1.00%

SHOCKED CASH FLOWS

Rate Shock	LIBOR	Potential Cap Cash Flows* Cost	Payment	Net	Funding Cost Base	Option*	Net
-3%	-0.21%	(1.00%)	-	(1.00%)	3.78%	1.00%	4.78%
-2%	0.79%	(1.00%)	-	(1.00%)	3.78%	1.00%	4.78%
-1%	1.79%	(1.00%)	-	(1.00%)	3.78%	1.00%	4.78%
Flat	2.79%	(1.00%)	-	(1.00%)	3.78%	1.00%	4.78%
+1%	3.79%	(1.00%)	1.00%	(0.00%)	3.78%	0.00%	3.78%
+2%	4.79%	(1.00%)	2.00%	1.00%	3.78%	(1.00%)	2.78%
+3%	5.79%	(1.00%)	3.00%	2.00%	3.78%	(2.00%)	1.78%

** Note that in some instances payment from the embedded derivative may be capped toavoid allowing the borrowing rate to go negative, which would require bifurcation under FAS 133*





TECHNICAL NOTE:

This structure receives the full benefit of the embedded cap(s) until LIBOR reaches 7.57%. At that point, the borrowing rates hits 0% and can fall no further without triggering bifurcation under FAS133. Technically, this is accomplished by selling 1 'embedded' floor(s) struck at 7.57%; These 'short' options often have little to no value but if they do their annualized cost should reduce the borrowing rate. This makes the structure effectively a 'corridor' rather than a pure cap.

REMEMBER:

The borrowing rate can NEVER go below 0%

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Playing defense when asset-sensitive…

FLOATING RATE FUNDING WITH EMBEDDED LONG FLOOR(S)

INPUTS

Option Type (**C**ap/**F**loor)	F	(Floor)
3 Month LIBOR	2.79%	
F**L**oating / Fi**X**ed Funding?	L	(Float)
Strike Rate	2.79%	
Maturity (Years)	3	
Up-Front Cost	0.65%	
Total # Floors Used	2	
Fixed Rate Funding - 3 Years	3.78%	

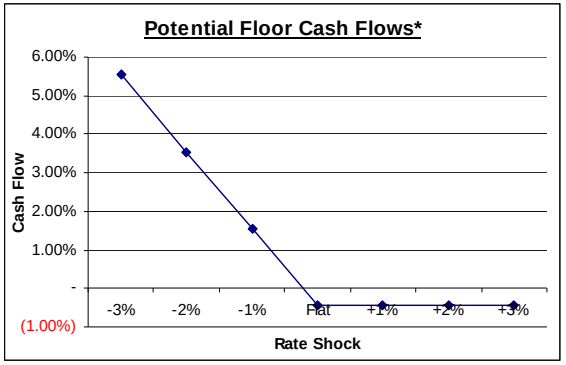
CALCULATIONS

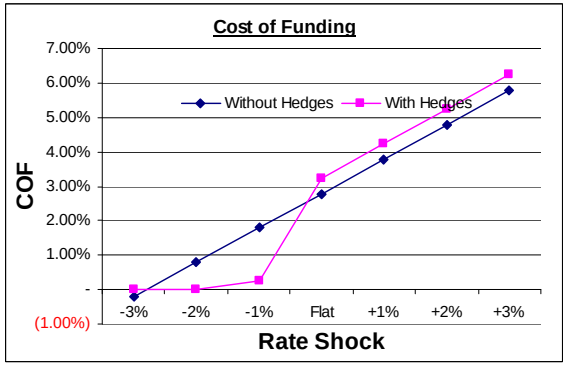
Option Duration (years)	2.86
Annual Option Cost (1 Floor)	0.23%
Annual Option Cost (Total)	0.45%

SHOCKED CASH FLOWS

Rate Shock	LIBOR	Potential Floor Cash Flows* Cost	Payment	Net	Funding Cost Base	Option*	Net
-3%	-0.21%	(0.45%)	6.00%	5.55%	(0.21%)	0.21%	0.00%
-2%	0.79%	(0.45%)	4.00%	3.55%	0.79%	(0.79%)	0.00%
-1%	1.79%	(0.45%)	2.00%	1.55%	1.79%	(1.55%)	0.24%
Flat	2.79%	(0.45%)	-	(0.45%)	2.79%	0.45%	3.24%
+1%	3.79%	(0.45%)	-	(0.45%)	3.79%	0.45%	4.24%
+2%	4.79%	(0.45%)	-	(0.45%)	4.79%	0.45%	5.24%
+3%	5.79%	(0.45%)	-	(0.45%)	5.79%	0.45%	6.24%

** Note that in some instances payment from the embedded derivative may be capped toavoid allowing the borrowing rate to go negative, which would require bifurcation under FAS 133*





TECHNICAL NOTE:

This structure receives the full benefit of the embedded floor(s) until LIBOR reaches 1.71%. At that point, the borrowing rates hits 0% and can fall no further without triggering bifurcation under FAS133. Technically, this is accomplished by selling 3 'embedded' cap(s) struck at 1.71%; These 'short' options often have little to no value but if they do their annualized cost should reduce the borrowing rate. This makes the structure effectively a 'corridor' rather than a pure floor.

REMEMBER:

The borrowing rate can NEVER go below 0%

Why Consider the Floored Floater Advance?

Excellent protection for ***asset-sensitive*** balance sheets.

- A win/win, whether rates rise or fall:
  - If rates fall:
    - An “in-the-money,” interest-rate floor can generate an advance rate that is significantly lower than that of a standard floating-rate advance.
    - The borrower gains a “two-for-one” rate reduction, resulting from the decline in LIBOR as a rate index and monetization of the interest-rate floor
  - If rates rise, asset sensitive balance sheets benefit from the impact of re-pricing.
- No upfront, out-of-pocket payments. The cost of the floor is blended into the rate of the advance.
- Avoids the need to mark-to-market an interest-rate floor because it is a contractual feature within the advance.

Why Consider the Capped Floater Advance?

Excellent protection for ***liability-sensitive*** balance sheets.

- A win/win, whether rates rise or fall:
  - If rates rise:
    - An "in-the-money," interest-rate cap can generate an advance rate that is significantly lower than that of a standard floating-rate advance.
    - The borrower caps their interest expense.
  - If rates fall, the borrower benefits from the floating-rate index, and can re-price with the fall in rates.
- No upfront, out-of-pocket payments. The cost of the cap is blended into the rate of the advance.
- Avoids the need to mark-to-market an interest-rate cap because it is a contractual feature within the advance.

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AUCTION ADVANCE OFFERINGS

The Seattle Bank offers Auction Advances with 28-, 63-, 91-, and 182-day terms.

Orders are accepted until 8:15 a.m. on Tuesdays and Thursdays for Wednesday and Friday settlements, respectively. Orders for each Auction Advance may be placed as soon as the rate on the previous auction has been established.

The frequency of Auction Advances offerings is subject to change at any time.

Read the Strategy: The Capped Floater Advance: Is the time right?

NEW SEATTLE BANK OFFERING

Capped Floater Advance

Structure	Features	Rate Indication*	Deadline
Capped Floater Advance	3-year 3.75% Cap on 3M LIBOR Terms (pdf)	3.80%	10:00 a.m. PT 6/13/08
Capped Floater Advance	5-year 4.25% Cap on 3M LIBOR Terms (pdf)	3.97%	10:00 a.m. PT 6/13/08

*As of 6/9/08

TODAY'S RATES

Advances

Overnight Advances
Short-Term, Fixed-Rate
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Adjustable Rate Advances

Investments

Demand Deposits
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Advances

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Cash Management (CMA):
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