

# An Introduction to Floating Rate CMOs

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Floating rate CMOs are bonds that have a floating interest rate (i.e., a coupon indexed to a rate benchmark, typically 1-month LIBOR). The rationale for creation of these securities is to split up mortgage cashflows into two components—one that predominantly bears the prepayment or convexity risk (Inverse Floater / inverse IO) and the other that has significantly lower risk exposure (Floater). Floaters and inverses are created either from passthroughs or a combination of trust IOs and POs. The most common structures are to create strip floaters/inverse IOs or strip floaters/inverse floaters. In addition, the most common CMO tranches—PACs, sequentials, and even supports—can be split up into a floater and inverse. This piece is an introduction to the sector: we discuss structuring alternatives, the framework for valuation of these securities, and their risk characteristics.

## 1. STRUCTURE

The two most common structures are the floater-inverse IO combination and the floater-inverse floater combinations. A floater pays a coupon that is equal to an index, usually 1-month LIBOR, plus a fixed spread called the margin (or the add-on). Interest payments are subject to a cap, typically between 7%-9% (i.e., irrespective of the level of LIBOR, the coupon on the floater cannot be higher than the cap, say 9%). As we discuss later on, the cap on the floater determines most of the variables in the structure—sizing, index multiples, and so on. The floater also has an implicit floor equal to the margin. Inverse IOs and inverse floaters, on the other hand, pay an interest that is inversely related to the index.

### 1.1. Floater / Inverse IO

When creating a floater/inverse IO structure, the biggest limitation is the cap on the floater. Floater buyers are not interested in purchasing a floater with a cap that is

Figure 1. Fixed Rate to Floating

1. Fixed Rate coupon split into floating and inversely floating parts
2. Cap on floater set
3. Inverse constructed so floater and inverse cash flows match fixed rate, regardless of level of index

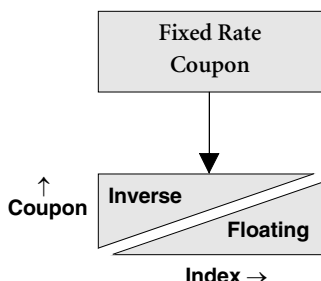


Figure 2. Characteristics of Floating Rate Securities

Item	Description	Examples
Index	Underlying rate off of which the coupons are based	1m Libor, COFI, 1yr MTA
Cap	The highest coupon the security can pay	7%, 7.5%, 8%, 8.5%
Multiple	Factor that the inverse IO coupon changes when the index changes	-1, -1.5, -2, -3
Floor	The lowest coupon the security can pay	30bp, 40bp

*The constraint on the floater/inverse IO structure is the cap on the floater.*

too low. However, most collateral being issued today has a net WAC of 5%-6%, which is well within the reach of 1-month LIBOR over the average life of the MBS. Therefore, a synthetic premium with a coupon of 7% or greater is usually created. The floater can then be created off of the synthetic premium with significantly higher caps than the underlying collateral.

*Synthetic Premium can be created by stripping off a PO from a pass-through, or combining an IO and a PO.*

*Creating Synthetic Premiums*

There are two ways to create synthetic premiums, and they use different starting securities. Starting with a pass-through, a synthetic premium can be created by stripping off a PO (Figure 3). Once a PO is stripped off, the residual bond has a coupon greater than the original pass-through. In the example below, \$100 million of 6% collateral is used to create \$25 million of a PO and \$75 million of a 8% synthetic premium. To create a higher cap on the floater, more PO needs to be created. While this structure seems natural, a PO created as such is not as liquid as trust POs, hence structurers normally favor a second alternative. This route involves using a combination of an IO and a PO (Figure 4). If a greater amount of IO is used, the resulting security should have a higher coupon than the original pass-through from which the IO and PO were created.

*A floater and an inverse IO are created from the synthetic premium.*

*Creation of the Floater and the Inverse IO*

Once the synthetic premium has been created, the cash flows are split up into a floater and an inverse IO (Figure 5). In this illustration, the margin on the floater is 30 bp and the cap is 8%, equal to the coupon on the synthetic premium. The cap on the inverse is determined by the difference between the coupon on the synthetic and the margin on the floater. One intuitive way to remember this is that when LIBOR hits 0, the underlying synthetic pays 8% while the floater pays 30 bp, and hence the inverse IO can pay 7.7% (8.0% – 0.3%). In the example below, if 1-month LIBOR were 2%, the floater should receive a coupon of 2.3%, and the inverse IO should receive a coupon of 5.7%.

*Floater/inverse floater pairs are created from pass-through collateral because the cap can be adjusted by varying the size of the two securities.*

**1.2. Floater / Inverse Floater**

The second standard floater structure pairs the floater with an inverse floater, instead of an inverse IO. The difference is that the inverse floater receives principle payments along with the floater, while the IO doesn't. Floater-inverse floater combinations are not usually created from synthetic premiums, but are usually created from traditional pass-through collateral. The reason a synthetic premium is not necessary is because a sufficiently high cap on the floater can be created by adjusting the relative face of the floater and inverse. The smaller the floater, the higher the cap and vice versa. This way, relatively low coupon collateral can be used to create floaters with a high cap.

Figure 3. Synth. Premium and PO created from Pass-through

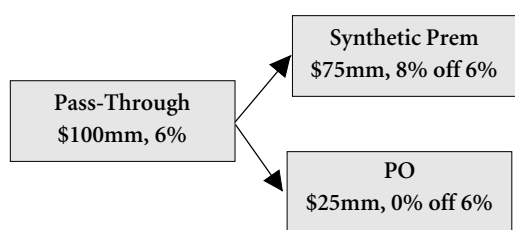


Figure 4. Synthetic Premium created from IO and PO

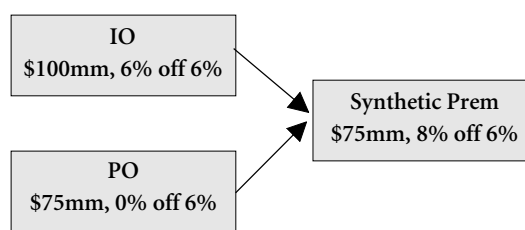


Figure 5. Floater and Inverse IO created from Synthetic Premium

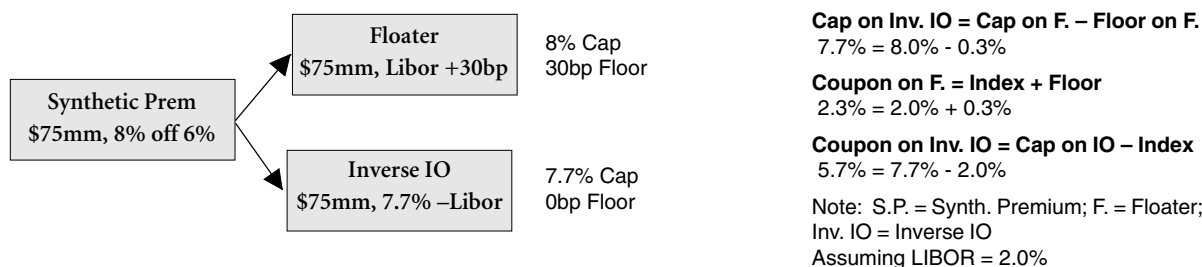
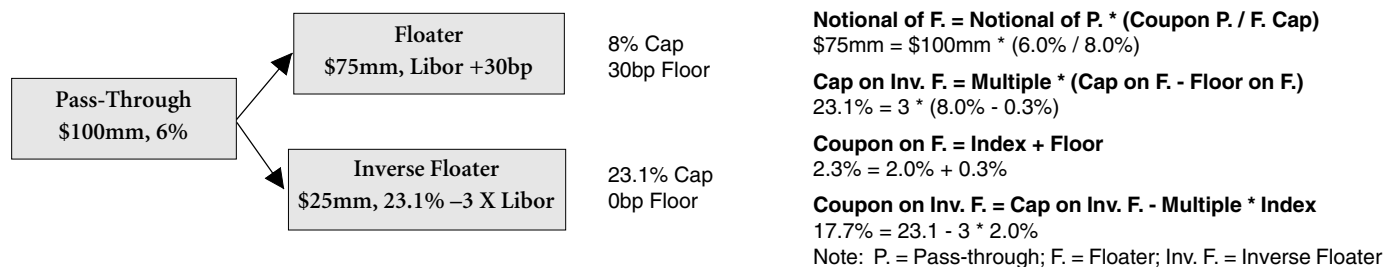


Figure 6. Floater and Inverse Floater created from Pass-through



*The cap on the floater controls the structure of the entire floater/inverse floater deal.*

*The Relevance of the Floater Cap*

The cap on the floater is the most important determinant of the entire floater – inverse floater structure. Once the cap is set, the size of the two securities is determined. For example, if the collateral has a 6% coupon and an 8% cap is required, the size of the floater is set at 75% ( 6 / 8). Deciding the cap also selects the multiple on the IO because there should not be any residual index sensitivity. The multiple of the inverse is always negative and is calculated by dividing the notional of the floater by the notional of the inverse. The only thing left to decide is the margin on the floater and that is usually chosen such that the floater has a par price (we discuss this in detail later).

**2. VALUATION**

Structured derivatives have risk exposures that are different compared with other CMOs and collateral, and, hence, the framework for valuation of these securities is different as well. In this section we discuss the pricing of floaters and inverse floaters/ IOs.

**2.1. Floaters**

*Floaters are generally quoted on a Discount Margin basis, which is the spread between the yield and the benchmark rate.*

Floaters are traditionally quoted on a Discount Margin (DM) or Net Effective margin (NEM) basis. The only difference between these two measures is the frequency of compounding: DM compounds monthly while NEM compounds semi-annually. Discount margin is the spread between the yield on the floater and the benchmark rate. The margin (the add-on) on the floaters is usually chosen such that the price of the floater is par, so that the discount margin is usually equal to the margin at creation.

*The discount margin on a floaters is proportional to the optionality, which comes from the cap.*

The DM of a floater, in turn, is directly related to the optionality of the security, predominantly arising from the caps on the floaters. The greater the optionality, the greater the spread over the index the owner needs to be compensated for the negative

convexity of the bond. There are three factors that control the degree of this risk: the strike on the cap, the average life, and the convexity of the underlying collateral. Obviously, the higher the cap, the less likely are interest shortfalls versus a fully index rate, hence the lower the option cost on the floater. Second, the shorter the average life, lower the option cost, once again for intuitive reasons. Finally, when the collateral or the tranche underlying the floater has worse convexity, the floater ends up with slightly greater optionality.

As shown in Figures 7 and 8, the above-mentioned factors translate into a few trends in DM across cap and underlying collateral:

- Across collateral, floaters with higher caps have lower option costs and lower DMs. In 30-year 6.0s, for instance, an 8.5% cap strip floater should have a 10 bp lower option cost than an 8.0% capped floater.
- 15-year floaters have lower optionality than their 30-year counterparts. This is partly explained by the lower average life and partly by the better convexity of the underlying collateral.

*Strip inverses and IOs are valued using creation value methodology, while structured inverses and IOs are valued using breakeven methodology.*

**2.2. Inverse Floaters and Inverse IOs**

There are two common methodologies adopted for valuation of inverse floaters and IOs. For strip inverses / IOs, it is easy to compute the creation value of the security, which is just the difference between the market value of the underlying collateral / synthetic premium and that of the floater (For details, refer to Figure 9). Structured inverses and inverse IOs are slightly more complicated form of structured derivatives—they are created off of PACs, sequentials or support bonds, where often times the price of the underlying tranche is not clear, leaving investors to use a different route to price these securities.

**The Break-even Methodology**

*Breakeven methodology uses the breakeven percent and breakeven OAS to create a model which does not have any biases towards IOs or POs.*

Over the short-term, structured inverses and IOs are priced using OAS. However, over the long-term, they are priced using what is referred to as the breakeven methodology. The most liquid trust matching the underlying collateral is identified for the breakeven analysis. The IO and PO are run in the model, adjusting the percentage of the model

Figure 7. Floater DMs across CPR and Cap %

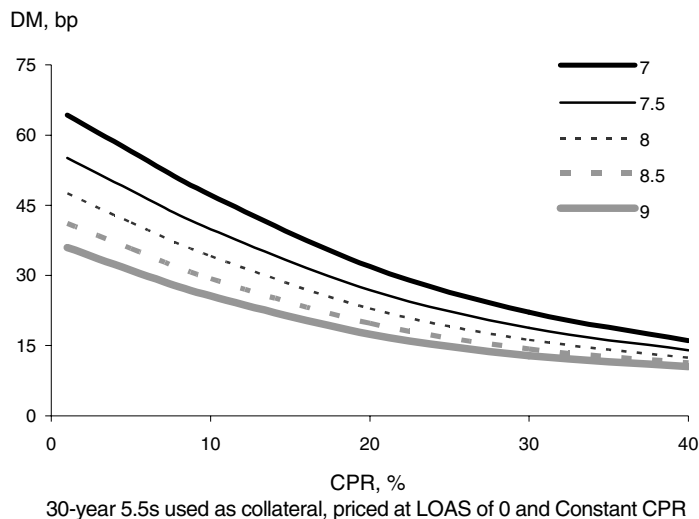


Figure 8. Floater DMs across Collateral Type and Cap %

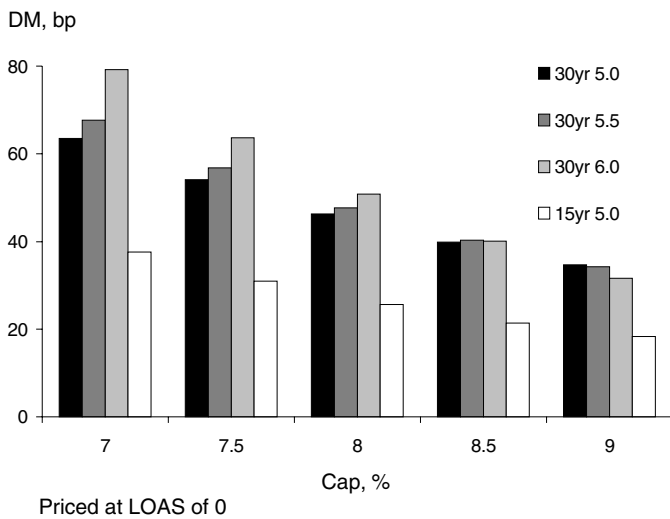


Figure 9. **Computing Creation Value for an Inverse IO**

<p><b>Properties of Inverse IO:</b>                  Underlying Collateral:                  30-year FN 5.0s                  Cap: 7.6%                  Index: 1m Libor                  \$100mm Original Face</p>	<p>→</p>	<p><b>Likely Synthetic Structure:</b>                  Underlying Collateral:                  30-year FN 5.0s                  8% Coupon                  \$100mm Original Face</p>	<p>→</p>	<p><b>Matching Floater:</b>                  Underlying Collateral:                  30-year FN 5.0s                  Cap: 8.0%; Floor: 40bp                  Index: 1m Libor                  \$100mm Original Face</p>
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**Calculating Creation Value of Inverse IO:**

Select trust with same collateral as underlying, 30-year FNMA 5%: Trust 347  
 Create S.P. from Trust IO and PO: \$160mm IO + \$100mm PO = \$100mm 8% S.P. off of 5%  
 Value of Synthetic Premium:  $(160 * \$25-29 + 100 * 73-10) / 100 = \$114-29$   
 Price Floater at 40 DM = \$99-29+  
 Creation Value of Inverse IO = Synthetic Premium - Floater  
 100mm of Inverse IO at \$14-31+ = 100mm of S. P. at \$114-29 - 100mm of F. at \$99-29+  
 Note: Price of IO and PO may need to be adjusted so all settlement dates match;  
 S. P. = Synthetic Premium

used, such that they have the same option adjusted spread (OAS). The percentage of the model at which the IO and the PO have the same OAS is called the *breakeven percent*. The price of the structured IO is computed using the *breakeven percent* of the model and the *breakeven OAS*. The price of the IO is usually close to the price derived this way (called the *breakeven price*). What is the relevance of the breakeven model? By creating a model where the IO and the PO trade at the same price, we are in a way taking out inherent model biases. Alternatively, you are benchmarking the price of the structured IO to that of the trust IO. In our model, very short average life securities trade at 100%-105% of the breakeven price. As the average length of the structured product increases, the percentage of the breakeven price that they trade at decreases. Structured inverse and IOs with an average life of 10 years or more may trade at a significant discount to breakeven value.

Refer to appendix A for a more detailed discussion of break-even methodology.

**3. RISK EXPOSURES AND INVESTMENT STRATEGIES**

**3.1 Floaters**

*Floaters do not have much risk from traditional sources such as duration, curve, and convexity.*

While floaters do have the additional risk of the cap, the risks from traditional sources, such as duration, curve exposure, and convexity, are all well below collateral. Most floaters have a duration of 0.5-2 years. Initially one might think that because a floater resets its caps periodically, the duration could only be as long as the time between the coupon is reset. However, the cap on the floater gives it a short positive duration. As in the case of option cost, the duration of the floater will depend on the convexity, amortization schedule, and coupon of the underlying, as well as the cap.

**3.2 Inverse Floaters**

*Inverse floaters have a longer duration than collateral, with a similar curve exposure and greater optionality.*

To understand the risk exposures of inverse floaters, one should view them as the residual left when a floater is created off of collateral. To start with duration, given that current coupon collateral typically has a 5-year duration and the floater usually has a very short duration, the inverse floater should have significant duration. As shown in Figure 11, depending on the underlying and the cap, the duration of an inverse floater varies between 7 and 14 years. The curve exposure of an inverse floater is fairly similar to that of the

Figure 10. Floater Risk Exposures across Caps and Collateral

Collateral	Cap	OAD	OAC	OAD		-15 PSA	-10 Refi Elbow	DM
				2s	10s			
30yr 5.5	7.0	1.9	-0.8	-0.2	2.2	-0.2	0.1	67.7
30yr 5.5	7.5	1.6	-0.8	-0.2	1.7	-0.2	0.0	56.8
30yr 5.5	8.0	1.2	-0.8	-0.2	1.4	-0.1	0.0	47.7
30yr 5.5	8.5	0.9	-0.8	-0.2	1.1	-0.1	0.0	40.3
30yr 5.5	9.0	0.6	-0.8	-0.2	0.8	-0.1	0.0	34.3
30yr 5.0	8.0	0.4	-0.4	-0.1	0.5	-0.1	0.0	25.6
30yr 5.5	8.0	1.2	-0.6	-0.2	1.5	-0.1	0.0	46.3
30yr 6.0	8.0	1.2	-0.8	-0.2	1.4	-0.1	0.0	47.7
15yr 5.0	8.0	1.1	-0.9	-0.1	1.2	0.0	0.0	50.8

-15 PSA and -10 Refi are change in price (points) for 15% PSA decline and 10bp decline in refinancing threshold, respectively

Figure 11. Inverse Floater Risk Exposures across Caps and Collateral

Collateral	Cap	OAD	OAC	OAD		-15 PSA	-10 Refi Elbow
				2s	10s		
30yr 5.5	7.0	11.7	-8.4	5.7	6.0	-0.6	-0.5
30yr 5.5	7.5	11.1	-7.1	4.7	6.3	-0.7	-0.3
30yr 5.5	8.0	10.6	-6.2	3.9	6.7	-0.7	-0.2
30yr 5.5	8.5	10.2	-5.7	3.5	6.7	-0.7	-0.2
30yr 5.5	9.0	9.8	-5.4	3.1	6.7	-0.7	-0.1
30yr 5.0	8.0	7.8	-2.4	3.9	3.9	-0.2	-0.1
30yr 5.5	8.0	12.6	-2.2	3.6	9.0	-1.0	-0.1
30yr 6.0	8.0	10.6	-6.2	3.9	6.7	-0.7	-0.2
15yr 5.0	8.0	7.8	-6.9	4.3	3.5	-0.4	-0.6

-15 PSA and -10 Refi are change in price (points) for 15% PSA decline and 10bp decline in refinancing threshold, respectively

underlying collateral. This is intuitive considering that the floater does not have much curve exposure. Curve exposure trends across inverse floaters follows that of the underlying collateral. Across caps, the higher the cap the more of a flattener the inverse floater is. On the convexity front, once again, the optionality of the inverse floater is a function of the underlying collateral and the amount of inverse created. Inverses off of cuspy collateral and in deals with lower floater caps have greater optionality. Finally, almost all the prepayment exposures of the underlying collateral are carried over by the inverse floater.

### 3.3 Inverse IOs

The risk exposures of an inverse IO are similar to that of an inverse floater in that they look like the residual after a floater is created off of the synthetic premium. They are dissimilar in that these securities do not receive principal. Unlike the collateral that we start out with, the synthetic premium has a shorter duration. As a result, an inverse IO usually has a duration close to zero or negative. Further, an inverse IO has a significant curve steepening bias due to its IO-like nature and the fact that the lower 1-month LIBOR is, the greater the coupon the inverse IO receives. Intuitively, an inverse IO benefits from slower speeds or lower short-term rates, which a steeper yield curve results in. Due to the lower market value of the inverse IO overall, the negative convexity is magnified several times from collateral. Overall, the risk exposures of an inverse IO look much more similar to a trust IO than an inverse floater.

*Inverse IOs have risk profile similar to Trust IOs. They have a duration close to zero or negative and have a significant curve steepening bias.*

Figure 12. Inverse IO Risk Exposures across Caps and Collateral

Collateral	Cap	OAD	OAC	OAD		-15 PSA	-10 Refi Elbow
				2s	10s		
30yr 5.5	7.0	-1.9	-35.1	23.0	-24.9	0.2	-0.5
30yr 5.5	7.5	-5.5	-34.4	13.2	-18.6	0.3	-0.6
30yr 5.5	8.0	-8.3	-33.8	10.2	-18.5	0.3	-0.7
30yr 5.5	8.5	-10.6	-33.3	8.4	-19.1	0.4	-0.7
30yr 5.5	9.0	-12.6	-33.1	7.2	-19.7	0.4	-0.8
30yr 5.0	8.0	2.2	-33.4	8.0	-5.8	0.4	-0.5
30yr 5.5	8.0	-8.3	-33.8	10.2	-18.5	0.3	-0.7
30yr 6.0	8.0	-11.7	-18.1	10.6	-22.3	0.2	-0.6
15yr 5.0	8.0	5.1	-19.1	12.0	-6.9	0.2	-0.3

-15 PSA and -10 Refi are change in price (points) for 15% PSA decline and 10bp decline in refinancing threshold, respectively

*Inverse floaters are a good way to bet against the forwards and also offer an opportunity to take advantage of cheap underlying collateral.*

### 3.4 Investment Strategies

Given the above mentioned risk characteristics, one can imagine the inherent bets placed in investing into different floating rate instruments. Floaters are a way to express an extremely bearish strategy. On the other hand, inverse floaters and inverse IOs are normally used for the following reasons:

- a. **Betting against the forwards:** Inverse IOs provide a good way to bet against forwards. Due to the inherent curve steepening bias, these securities benefit if the bear flattener that is priced into the curve does not materialize.
- b. **Sell Convexity:** Similar to IOs, inverses / inverse IOs are alternatives to pick up carry by selling convexity. If the view is that realized volatility in rates should be low, holding these securities and dynamically hedging their duration should result in potential gains if that materializes.
- c. **Cheap Valuations of Underlying Collateral:** The last and the most important reason for creation of inverse floaters and IOs is to take advantage of cheap valuations of the underlying collateral. If the view is that the market is not correctly valuing the convexity of a given class of pools, buying inverse floaters / IOs off of these pools is a way to monetize their inherent cheapness since these securities carry over the prepayment/convexity risk as well as the yield spread in a levered form.

## 4. ADDITIONAL STRUCTURES

### 4.1 Inverse Floater with Floor

*Inverse floaters with a floor are a more conservative approach to the traditional inverse floater. The coupon has a lower bound even if the index moves very high.*

A more conservative alternative to the vanilla inverse floater is where the coupon formula includes a floor i.e. an absolute minimum level of the coupon payment. We show the coupon payment profile in Figure 13. While the maximum coupon of this bond is 11.5% (struck at 0% 1-month LIBOR), the coupon floor is set at 5%, implying a lower bound on yields in the more adverse index scenarios. Additionally, the index multiplier on this bond is much lower, implying significantly less coupon cash flow variability. The downside, to be sure, is the lower yield in the more benevolent index and prepayment scenario. While these securities are bets against the forwards, they are less bullish than their non-floored counterparts.

### 4.2 Two Tiered Inverse Bonds (TTIBs)

Another leveraged class of securities in the CMO market are the two tiered inverse bonds, popularly termed as TTIBs. These securities are similar to range notes and pay a fixed coupon

Figure 13. **Coupon on Inverse Floater with Floor**

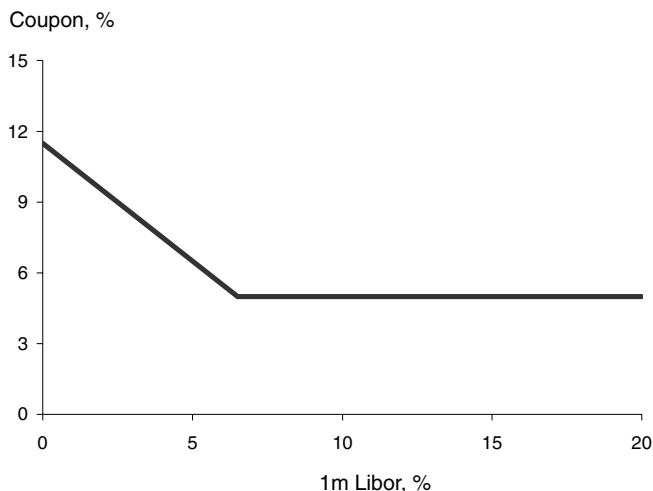
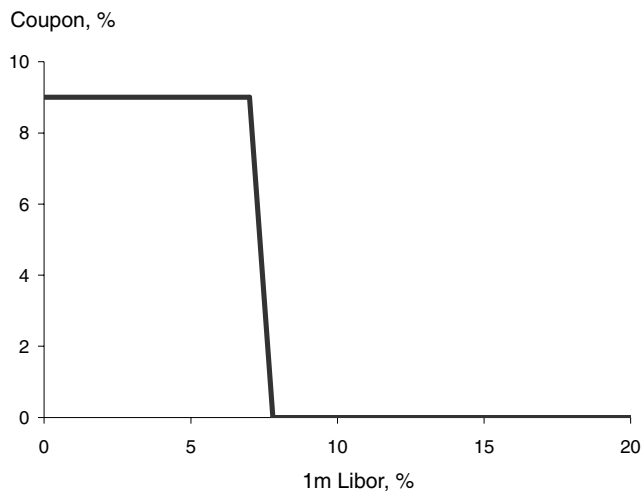


Figure 14. **Coupon on TTIB (Two Tiered Inverse Bond)**



*Two Tiered Inverse Bonds (TTIBs) pay a fixed, high coupon as long as 1-month LIBOR stays below a threshold.*

as long as 1-month LIBOR stays below a certain threshold. Once 1-month LIBOR crosses this threshold, the coupon on bond steadily declines and finally floors at 0%. As with inverse floaters, lower LIBOR rates are good for investors, and TTIBs are an attractive strategy to bet against the prevailing steep yield curve. As we discuss below, investors can buy certain structured tranches that offer up to 9.5% yield as long as 1-month LIBOR stays below 7%.

In Figure 14, we graph the coupon payment profile for a standard TTIB. The coupon formula for this bond is  $87.75\% - 11.25\% \times 1\text{-month LIBOR}$ , with a 9% cap i.e. the bond pays fixed 9% coupon as long as 1-month LIBOR is below 7% and becomes a zero coupon for 1-month LIBOR higher than 7.8%. In other words, the TTIB has a 7.0-7.8% “corridor” on 1-month LIBOR.

*TTIBs are a bet against rising forward rates. The structure is such that the yield remains high, even if the forward curve is realized.*

As the inverse floater, a TTIB is a bet against rising forward rates. The investor is essentially shorting an option that 1-month LIBOR will not increase beyond a certain threshold and, in return for that risk, is compensated with a higher coupon. From a cashflow perspective, the yield on the bond remains quite high even when using very conservative assumptions around forward LIBOR rates. 1-month LIBOR would have to increase to over 7% for the coupon to drop below 9%. At no point on the forward curve does 1-month LIBOR 7%, implying that the TTIB performs very well even if the forward curve is realized, yielding a robust 9.2%. The downside is in the more aggressive scenarios, where 1m Libor increases by more than what the forwards imply and the underlying collateral simultaneously extends. In these scenarios, the yield declines significantly and is very sensitive to any additional incremental change in LIBOR and/or prepayment speeds.

*TTIBs are similar to agency step range notes. The difference is that TTIBs only have an upper limit on LIBOR, while range notes have a much tighter range.*

Of course, without incremental risk exposure, it will be impossible to find agency credit securities with such high yields. A similar product as a TTIB are Agency Step Range Notes. They are similar to TTIBs in the sense that the security pays a very high coupon based on certain conditions on the LIBOR. The primary difference is that while TTIBs impose only an upper bound on LIBOR, range notes pay coupon based on a much tighter range. Essentially this implies that the bond holders have less protection against rising LIBOR rates from a coupon income perspective. For example, if 1-month LIBOR does follow the forward curve, the average coupon of the range note is less than 8% over the next 7 years while the yield on the TTIB remains at 9.5%.

**APPENDIX A**

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**A Primer on Break-even Methodology**

An issue faced by mortgage investors is how to value structured mortgage derivatives versus their Trust IO/PO benchmarks, i.e. how to account for differences in prepayment leverage. Consider the case of a PAC, strip and companion IO. Clearly, the PAC IO has the lowest sensitivity to prepayments and the companion IO the highest. What does this imply for valuation? Should the PAC and companion IOs trade at different OASs or should it be the same?

Breakeven methodology is often used by investors and dealers to value structured mortgage derivatives versus the benchmark Trust IO/PO. Under this approach, the prepayment model is adjusted such that the benchmark Trust IO and PO have the same OAS at current market prices. The *fair* value of the structured mortgage derivative is then computed by using the adjusted prepayment model and pricing it to the same OAS as the Trust IO/PO. In the following sections, discuss this methodology. In brief:

**If Only Trust IOs and POs were Priced at Even OAS...**

A key issue in valuing structured mortgage derivatives is limited price discovery. Consequently, investors have to arrive at the *fair* value of the structured security based on market prices/OAS of benchmark Trust IOs and POs. The OAS difference between the IO and PO is a measure of market expectations of prepayments and/or the risk preferences of investors. If the market expects prepayments to be on average faster than

forecast by valuation models, OAS on IOs will be wider than that on POs. Similarly, in certain periods, (e.g. the 1998 crisis period) investors demand a greater premium for being short the prepayment option. In such an environment, OAS on IOs will be wider than that on POs. In both cases, companion IOs that have greater prepayment risk should be priced at a wider OAS whereas PAC IOs should be priced tighter than Trust IOs (not accounting for any differences in liquidity).

If IOs and POs are priced at the same OAS, determining the fair value of structured product is a relatively straightforward exercise. Under this regime, the market is essentially indifferent between being short or long the prepayment option, i.e. investors are risk neutral. This implies that, all else equal, securities with different prepayment leverage should all be priced at the same OAS. Unfortunately, very rarely are Trust IOs and POs priced at the same OAS. In Figure 12, we highlight the current OAS differences between benchmark IO/POs. As mentioned, these OAS differences indicate that

- Market expectations of prepayments are different from that forecast by our model *and/or*
- The market demands a different premium for being long versus short the prepayment option

**Determining the Constant OAS Model**

Using break-even methodology, investors can price prepayment risk reasonably consistently across different instruments with varying degrees of prepayment leverage. The underlying idea behind the break-even methodology is to

Figure 12. **OAS Difference Between Trust IOs and POs Across Coupons**

Cpn.	Trust	OAS (model)		Break-even Analysis	
		PO	IO	OAS	% model
6.0	FHT-201	-5bp	27bp	6bp	102
6.5	FHT-199	-18	35	-1	104
7.0	FHT-205	-40	96	3	109
7.5	FNT-303	-72	188	5	116
8.0	FNT-306	-148	432	7	137

Figure 13. **Risk Profiles of Various Structured POs Backed by 6.5s**

Security	Average life profile (yrs)			Sensitivity (32nds)	
	-150	0	+150	Prepay <sup>1</sup>	Spread <sup>2</sup>
FHT 199	6.1	8.2	8.9	4+	6
PAC	11.2	11.2	11.2	2	7
Companion	0.9	21.1	23.2	8	11
Short sequential	4.3	6.1	6.6	4+	5
Long sequential	15.1	18.6	19.9	5+	7

<sup>1</sup>Price change at constant OAS for 1% increase in prepayment model.  
<sup>2</sup>Price change at constant OAS for 10bp spread widening.

adjust the prepayment model such that at current market prices the OAS of the IO and PO are the same. Using the adjusted model, securities with different prepayment leverage should all have the same OAS, with the usual caveat—*all else equal*. The adjustment to the model is made by varying the percentage of model applied. Thus, if IO OAS is wider than that on the PO, the break-even percentage of model required will be greater than 100%. In Figure 12, we also highlight the break-even percentage of the model across coupons. Using the example of 6.5s, in the base model, OAS on the IO and PO are -18 bp and 35 bp respectively. At 104% of the model, both the IO and PO have the same OAS of -1 bp.

### Valuation of Structured POs Using Break-even Methodology

In this section, we highlight the valuation of various structured POs using break-even methodology. For illustrative purposes, we use the examples of PAC and companion POs, and short and long sequential POs—all backed by unseasoned 6.5s. The benchmark Trust for these securities is FHT-199. We summarize the average life profiles and risk measures of these structured POs in Figure 13.

In Figure 14, we first price the various POs at even OAS to the benchmark Trust PO. We also highlight the price of these securities under break-even methodology, i.e. pricing them at -1 LIBOR OAS at 104% of the base prepayment model. The difference in these two prices is due to

- *Spread change*: Pricing the security at -1 bp OAS instead of -18 bp OAS

- *Prepayment impact*: The impact of increasing prepayments to 104% of the model

These two factors will *always* have opposite effects. Using this particular example, the price of the structured PO will be hurt by pricing at a wider spread, but will benefit from a faster prepayment model. Thus, the net impact on the price is an interplay of spread duration and prepayment duration. The PAC PO has relatively low exposure to prepayments, consequently the price computed using break-even methodology is lower than the price based on the production model and the Trust PO OAS of -18. The impact on the companion PO, as expected, is the reverse. The last column in Figure 14 shows the OAS on the structured POs in the base prepayment model using the break-even prices. Thus, when Trust POs are priced at tighter OAS than their counterpart IOs, OAS on companion POs using break-even prices will be even tighter—in this case, -34 bp versus -18 bp for the Trust PO.

- Using break-even methodology, investors can price prepayment risk across different instruments with varying degree of prepayment leverage.
- Contrary to common perception, this technique does not assume that in a perfect world IOs and POs should be priced at the same OAS.
- The main limitation behind the break-even methodology is that it adjusts the prepayment model by a certain percentage. Due to this, break-even prices under different base prepayment models could be potentially different.
- The other drawback of this valuation methodology is the implicit assumed cost of leverage. In the current environment, we understate the *fair* value of companion POs.

Figure 14. Break-even Analysis for Structured POs

Security	Model	Price Using Break-even Model (OAS = -1 @ 104% model)				
	OAS = -18	Spread (10+)/32	Prepay 10+ /32	Net Change 0/32	Price	OAS <sup>1</sup>
FHT 199	\$63-25				\$63-25	-18bp
PAC	49-27	(23+)	7+	(16)	49-11	-6
Companion	39-10	(17)	1-01+	16+	39-26+	-34
Short sequential	70-01	(16)	18+	2+	70-03+	-21
Long sequential	32-28	(23+)	22+	(1)	32-27	-17

<sup>1</sup>Using 100% of the model.

**Break-even Methodology: Some Limitations**

The basic rationale behind break-even methodology is to adjust the prepayment model such that at market prices OAS on IOs and POs is the same. The assumption is that under this adjusted model, all securities should have the same OAS, regardless of prepayment leverage. While the assumption is certainly reasonable, the bigger issue is what adjustment does one need to make to the model. Adjusting the model by a certain percentage need not necessarily be the right adjustment. For instance, if the market is undervaluing extension risk relative to model forecasts, an adjustment to arrive at the break-even model should be made by increasing turnover assumptions. Similarly, if the market demands a higher premium for refinancing risk, adjustments should be made by increasing the refinancing function. Thus, adjusting the prepayment model by shifting the overall level of the prepayment function by some percentage is not always the most appropriate methodology—although it certainly is the most straightforward one.

Due to this limitation, prices on structured securities by using break-evens could be potentially different under different starting prepayment models. We illustrate this point by using

break-evens to price the same set of structured POs with three different starting models—the production model, the production model + 15% PSA incremental turnover and finally, the production model with 10 bp lower refinancing threshold. As illustrated, depending on the choice on the base prepayment model, break-even even prices could vary quite significantly.

A key component in adjusting for prepayment leverage is the cost of leverage. The break-even methodology assumes the cost of leverage to be the same as the break-even OAS. In Figure 16, we illustrate this using the example of FHT-199 POs and the structured companion PO. Essentially, \$188 million current face of the Trust POs has same prepayment duration as \$100 million of the companion POs. Thus, investors can replicate the prepayment exposure of a \$100 million companion POs through a leveraged position in \$188 million Trust POs. Assuming the funding cost is the break-even OAS of LIBOR -1, the net OAS of the leveraged position in Trust POs is identical to the OAS on the companion PO. However, the funding cost for POs is typically higher than LIBOR -1. Assuming that the funding cost is LIBOR + 15 bp, the typical rate on a PO swap, it is more expensive to add a leveraged exposure to Trust POs than that assumed by the break-even methodology. Thus, the break-even methodology understates the value of the companion PO by 10 bp in OAS, i.e. <sup>11</sup>/<sub>32</sub>.

Figure 15. **Break-even Prices for Structured POs under Different Prepayment Models**

Security	Prod. Model	Less Extension	More Callable	Range
PAC	49-11	49-01+	49-16+	0-15
Companion	39-26+	39-09+	40-21+	0-27
Short sequential	70-03+	70-06	70-03	0-03
Long sequential	32-27	32-11+	32-31+	0-20

**CONCLUSION**

Despite some inherent limitations, break-even methodology is a very useful tool for accounting for differences in prepayment leverage. The primary advantage of this technique is that it is simple and yet, intuitively appealing. However, like most other simple and elegant valuation techniques, investors should be aware of the underlying assumptions and use it.

Figure 16. **Valuation of Trust and Companion POs under Different Funding Cost Assumptions**

Funding rate	LIBOR-1 bp		LIBOR + 15 bp	
	Trust PO	Comp. PO	Trust PO	Comp. PO
Prepay Duration (32 <sup>nds</sup> )	8	8	8	8
Face Amount Required	188	100	188	100
Buy (\$ MM)	100	100	100	100
Borrow (\$ MM)	88	0	88	0
Return on Asset (bp)	L - 18	L - 34	L - 18	L - 34
Funding cost (bp)	L - 1	0	L + 15	0
Net LIBOR OAS (bp)	L - 34	L - 34	L - 44	L - 34

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