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An Analysis of PAC IOs

In this article, we provide a simple but hopefully realistic analysis of the value of the structure provided by PAC IOs relative to standard trust IOs.

Standard Static Analysis. Our analysis compares two PAC IOs from FNMA 1997-53, classes PI and PK, with FNMA Trust 275 IO, a benchmark 8% IO. Class PK is, roughly speaking, the latter two-thirds of the notional principal of PI; class PJ is the first third, so that PJ and PK add up to class PI.

As implied by their PAC structure, PAC IOs typically show greater yield and WAL stability than trust IOs over a range of interest-rate shifts. This is illustrated in Figure 5, which shows yields for a range of parallel yield curve shifts.

Figure 5. Yields for FNMA Trust 275 IO and FNMA 1997-53 PI and PK PAC IOs, 20 Jul 97

	Interest Rate Move (bp)						
	-150	-100	-50	0	50	100	150
FN Trust 275 IO	-14.93	-10.20	0.92	9.92	14.93	17.47	18.11
FN 97.53 PI	-9.80	-4.46	6.95	11.33	11.16	11.16	11.16
FN 97.53 PK	-7.59	-2.38	7.42	10.79	10.60	10.60	10.60

Source: Salomon Brothers Inc.

As might be expected, the PAC IOs provide greater protection in bullish scenarios, but do not have as much upside potential in bearish scenarios, relative to the trust IO.

More Realistic Interest-Rate Scenarios. The numbers in Figure 5 are obtained by assuming that interest rates move in parallel by the stated amount, and *stay there*. In practice, of course, such scenarios will never occur; interest rates will change in unpredictable ways over the life of the MBS.

Salomon Brothers' **Yield Book** provides the capability to analyze MBSs under more realistic interest-rate paths. A large number of such paths are generated for OAS calculations, and the user can access the distribution of WALs (and also PVs of the cash flows) over the paths.[9]

The distribution of the WALs of the Trust 275 IO is almost uniform between roughly 1.5 years and 10.5 years. In contrast, the PAC IOs have more uni-modal distributions, with a concentration around the base case WALs. This greater stability of PAC IO WALs is also reflected in better convexity and lower option costs; for example, at current rate levels, the option cost of the Trust 275 IO is over 600bp, compared to just over 400bp for the class PI PAC IO and around 360bp for class PK.

A Whipsaw Scenario. How do the PAC IOs perform in a realistic bullish scenario, such as rates declining over the next six months to one year, then eventually increasing as the economy heats up? Let us assume that interest rates decline about 100bp over the next six months, and then subsequently start increasing, to the point where 8s are current coupons about three years from now. For such a scenario, our projected prepayment vector would (roughly speaking) be as shown in Figure 6.

Figure 6. Projected Scenario Prepayment Vector, 20 Jul 97

Months	CPR
1	20%
4	50
7	60
12	40
24	30
36	10
40 on	8

Source: Salomon Brothers Inc.

[9] *Yield Book* users can view the graph of WALs by clicking on the *Distribution* field near the middle of the right side of the "PY" screen

Thus, we project speeds to peak at around 60% CPR, and eventually level out at an annualized rate of 8% after three years, when the 8s are current coupons. **Using this CPR vector, class PI had a yield of 6.76%, class PK had a yield of 9.06%, while the Trust 275 IO had a yield of 0.57%.** Static analysis fails to capture the value of structure provided by the PAC IOs in more realistic scenarios such as this.

PAC IO Structures Under Increasingly Severe Prepayment Vectors. The structure of the FNMA 1997-53 deal helps the PAC IOs even under sustained periods of heavy prepayments. We analyze the bonds under the following prepayment vectors:

1. 40% CPR for 12 months, then 8% CPR for life

2. 40% CPR for 24 months, then 8% CPR for life

3. 40% CPR for 36 months, then 8% CPR for life

4. 40% CPR for 36 months, then 18% CPR for life

Roughly speaking, these vectors correspond to interest rates declining 50bp to 100bp, then eventually increasing, for (1), (2), and (3), to the point where 8s become current coupon. Vector (4) corresponds to a sustained period of low rates; note that an average speed of 40% CPR for 36 months implies a much higher peak speed.

Figure 7, which shows yields and WALs using these four vectors for the three IOs as well as the base case (model projections under unchanged interest rates), confirms the greater protection provided by the PAC IOs against declining interest rates.

Figure 7. PAC IOs More Robust in Bullish Interest-Rate Scenarios, 20 Jul 97

		Trust 275 IO	97-53 PI	97-53PK
Base Case	Yield	9.92%	11.33%	10.79%
	WAL	5.9 yrs.	9.3 yrs.	11.3 yrs.
Vector (1)	Yield	8.44%	14.28%	13.57%
	WAL	6.2 yrs.	12.3 yrs.	15.5 yrs.
Vector (2)	Yield	2.58%	9.05%	11.04%
	WAL	4.4 yrs.	9.3 yrs.	12.7 yrs.
Vector (3)	Yield	-1.67%	3.98%	6.01%
	WAL	3.4 yrs.	6.9 yrs.	9.3 yrs.
Vector (4)	Yield	-8.68%	-2.41%	-0.25%
	WAL	2.5 yrs.	4.9 yrs.	6.3 yrs.

Source: Salomon Brothers Inc.

An interesting feature of the PAC structure is highlighted by comparing the base case against vectors (1) and (2). Our base case projections for Trust 275 are 15.3% CPR for one year and 14.3% life, and for 1997-53, 14.1% CPR for one year, and 13.8% for life. For the trust IO, the yield declines as we move from the base case to (1) and (2). In contrast, for class PI, (1) provides a higher yield, while for PK, both (1) and (2) provide a higher yield. A year or two of high speeds for FNMA 1997-53 leads to the support classes being paid off; a subsequent slowdown then leads to the PAC IOs *extending* relative to the base case. Three years of 40% CPR speeds are needed before the PAC IOs start getting hit.

Summary. The PAC structure provides a layer of protection for PAC IOs that makes them more robust against declining interest rates than trust IOs. Analyzing the MBSs in realistic dynamic scenarios (such as "whipsaw" ones with rates declining and then eventually increasing) tends to highlight the benefits of PAC structures, such as greater cash flow stability and better convexity characteristics relative to trust IOs.