

Searching for the Virtuous FRM

Considering Cash Flows and TRR Analysis

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I was having an animated discussion with several lending officers recently about the risks involved with fixed-rate lending. You know the kind, lenders who have pumped-up originations and commissions by closing bunches of low monthly payment, teaser-rate ARMs throughout the refi-boom. They must be Democrats because they don't believe anyone should be able to afford the higher monthly payments associated with short-term mortgages. Oh, Oh, that wasn't a politically correct statement, was it? Well, don't be offended, just remember that as far as my politics are concerned, Rush Limbaugh is a liberal twinkle.

I said, "Without even considering prepayments, just normal amortization, I'll get back twice the cash flow from my 10-year fixed-rate mortgage than you would get back from a 3-year ARM amortized for 30 years." Looking down into my empty glass I added, "That's twice as much cash to reinvest, and in the event that the Federal Reserve freaks-out and pushes short-term rates into the stratosphere over the next three years, my 10-year FRM will give me better protection from rising rates than one will get from a 3-year ARM."

These lenders exclaimed "Bull" in unison and bet me a drink of club soda to back it up. So I whipped out my trusty HP-12C and hustled them with my keystrokes.

"OK," I said, "at what rate are you originating your ARMs?" "5.5%," they replied.

"Let's see," I mumbled, keying-in numbers, "\$100,000 PV @ 5.5% @ 36 @ equals a monthly payment of \$567.79, times 36 months gives you a total cash flow of \$20,440 over three years."

"Right! Right," they belched, looking over my shoulder.

"Now, let's do my mortgage \$100,000 PV @ 7.0% @ 120 @ equals a monthly payment of \$1,161.08, times 36 months gives me a total cash flow of \$41,799 over three years. That's more than twice your \$20,440 cash flow. Bingo! Pay up," I slurred. The fizz always gets to me. "If rates were really to takeoff, the cash flowing off the shorter-term mortgage would really serve to protect me, while your 3-year ARM would only recover half of the cash flow to reinvest at market rates."

"Hold on," they angrily exclaimed. They said that after three years my goose would be cooked because all of the remaining balances of the 3-year ARM would reprice to market rates.

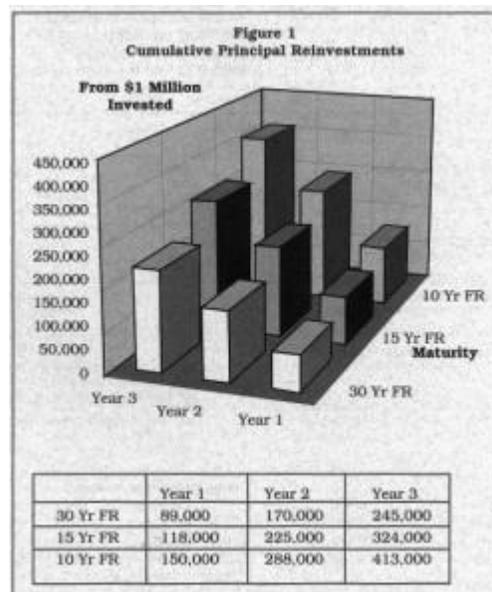
"Didn't they have a 2% cap on the first reset of the mortgage, I asked. "Yes," they admitted blankly.

I then said that their 5.5% origination rate plus the 2% cap would fix the ARM at 7.5% for the next three years. Not only did I beat them by 1.5% on mortgage interest earned for the first three years along with the reinvestment benefits of the faster cash flow, but, for the next three years I'd receive another doubling of reinvestible cash flow without the interference of caps while they were stuck with their 7.5% mortgage.

I said, swilling the last of my club soda, % interest rates really take off my goose will be just fine, but you'd better look in the oven for yours.+

Picturing Cash Flows

So. What do you think? Did I just luck-out with this particular choice of mortgage products? I don't think so. The power of reinvested cash flows to mitigate the apparent interest rate risk of fixed-rate mortgages is real. But these benefits have nothing to do with repricing frequency; they relate to the speed at which principal is being repaid.



The following examples are applications of the information explored more completely in Noel Fahey's book, *Measuring and Pricing Mortgage Risk*. Noel maintains correctly that lenders must consider the earnings of reinvested cash flows if they are to calculate the cash-flow rates of return of alternative mortgage instruments. Analyzing comparative cash-flow rates of return can result in lenders pricing mortgages more efficiently. Efficient design and pricing of mortgages can make all the difference in gaining the flexibility necessary to meet consumer demand.

The picture and table in Figure 1 shows the cumulative principal cash flows for three of the mortgage instruments displayed in Figure 2. It's the amortization of principal which accelerates the repayment of principal that drives the cash flow of these mortgages.

Figure 2

Cash Flows - By Year:	Rate Env:	Year 1	Year 2	Year 3	MB Val	BB Val
30 Yr FRM Mortgage - 7.25%	Flat	80,000	81,000	79,000	733,000	730,000
CFR 8% Flat, 8% Prepay	30 1-1-1	60,000	65,000	81,000	480,000	480,000
	FR 3-3-1 NP	80,000	80,000	81,000	671,000	670,000
	FR 3-3-1 P	80,000	85,000	81,000	585,000	605,000
15 Yr FRM Mortgage - 7.75%	Flat	118,000	127,000	89,000	488,000	478,000
CFR 8% Flat, 8% Prepay	15 1-1-1	80,000	80,000	89,000	402,000	412,000
	FR 3-3-1 NP	88,000	85,000	86,000	537,000	521,000
	FR 3-3-1 P	88,000	85,000	86,000	480,000	521,000
10 Yr FR Mortgage - 7.0%	Flat	200,000	198,000	193,000	492,000	487,000
CFR 8% Flat, 8% Prepay	10 1-1-1	132,000	124,000	118,000	340,000	336,000
	FR 3-3-1 NP	138,000	134,000	118,000	579,000	606,000
	FR 3-3-1 P	132,000	124,000	118,000	498,000	526,000
5 Yr Balloon Mortgage - 7.0%	Flat	92,000	92,000	79,900	370,000	370,000
CFR 8% Flat, 8% Prepay	5 1-1-1	70,000	65,000	63,000	191,000	203,000
	FR 3-3-1 NP	70,000	85,000	85,000	384,000	403,000
	FR 3-3-1 P	70,000	85,000	85,000	370,000	403,000
1 Yr ARM ARM-5 to Lock-5.25% - 1 Yr + 0.75%	Flat	135,000	118,000	100,000	603,000	603,000
CFR 12% Flat, 8% Prepay	1 1-1-1	80,000	85,000	70,000	390,000	390,000
	FR 3-3-1 NP	82,000	85,000	70,000	580,000	590,000
	FR 3-3-1 P	80,000	85,000	70,000	500,000	540,000
1 Yr ARM ARM-5 to ARM-6.1% - 1 Yr + 0.75%	Flat	138,000	114,000	99,000	679,000	679,000
CFR 12% Flat, 8% Prepay	1 1-1-1	80,000	84,000	70,000	340,000	347,000
	FR 3-3-1 NP	86,000	84,000	70,000	512,000	517,000
	FR 3-3-1 P	80,000	84,000	70,000	470,000	517,000
1 Yr COFI ARM ARM-5.25% - COFI+0.2%	Flat	132,000	114,000	101,000	609,000	609,000
CFR 12% Flat, 8% Prepay	1 1-1-1	80,000	85,000	69,000	378,000	378,000
	FR 3-3-1 NP	81,000	81,000	71,000	588,000	597,000
	FR 3-3-1 P	81,000	81,000	71,000	508,000	557,000

For instance, assuming a flat-rate environment and a constant prepayment rate of 8%, the 30-year FRM generates total principal cash flows of \$245,000 over three years. The 15-year FRM generates \$324,000 in principal cash flows and the 10-year FRM generates \$413,000 in principal cash flows over three years. Cash flow, ah wonderful cash flow, the elixir for the aches and pains of interest rate risk.

Cash flow that can be reinvested without worrying about interest rate caps.

Figure 2 shows the same three-year schedule of principal repayments for seven alternative mortgage instruments. We've listed principal repayments on these mortgages for various rate environments and prepayment speeds. Our choice of prepayment speeds is arbitrary, but we felt that the prepayment speed of FRMs would slow in rising rate environments and that ARMs are prepaying faster than FRMs, especially in the current rate environment. Note that both of these assumptions biased the results in the favor of ARMs.

In addition, three variations of rising rate environments were assumed: a gently rising 3% rate shock which increases 1% per year, and a parallel and nonparallel fast-rising 6% rate shock which increases 3% in the first year, 2% in the second year, and 1% in the third year. The non-parallel rate shock assumes that long-term rates rise by only 60% of the rise in short-term rates.

Figure 2 also shows the book value of the mortgages after three years of principal pay down and the resulting market value of the remaining balances under each rate environment. For instance, under the 6% parallel rate shock scenario, the 30-year FRM is marked-to-market at \$595,000, \$210,000 below its remaining book value of \$805,000. On the other hand the 10-year FEM valued at \$540,000 is only \$86,000 below its remaining book value of \$626,000. The shorter-term (shorter duration) FRM suffers only about 40% of the decline in market value of the longer-term FEM. We should note that we're valuing these mortgages at a secondary market rate approximately forty to fifty basis points below their retail coupon.

It's also intriguing to note the extent to which the fast-rising rate scenarios sink the ARM products under water. For instance, after three years the COFI ARM is valued at \$694,000, \$63,000 below

its remaining book value of \$757,000. That's almost 75% of the loss in market value of the 10-year FRM! And it's the interaction between the annual interest rate caps and the initial teaser rate on the ARM which produces the extent of the difference. Portfolio lenders can really act to minimize the size of this mark-to-market hole by allowing the rates to rise by the full margin at the first-rate reset date. The lifetime cap should be figured from this first reset date if the lender wishes to avoid an accelerating loss of market value in the event of continually rising interest rates.

Using Total Rate of Return Analysis

To evaluate the total rate of return of the mortgage investments one must consider:

- (1) The value of the reinvested principal and interest cash flows over the chosen holding period, and
- (2) The market value of the mortgage at the end of the holding period.

Figure 3
Original Investment 1,000,000
Investment Date 1/1/94 Redemption Date 1/1/97

Part A	Value After 3 Years - Same Rate Rates			
	Flat	FR 3-1-1	FR 3-2-1 3P	FR 3-2-1 P
Investment Instrument				
30 Yr FR Mortgage - 7.5%	1,277,000	1,128,000	1,113,000	1,050,000
15 Yr FR Mortgage - 7.1%	1,355,666	1,158,000	1,132,000	1,094,000
10 Yr FR Mortgage - 7.0%	1,343,000	1,184,000	1,180,000	1,131,000
5 Yr Balloon Mortgage - 7.1%	1,245,000	1,323,000	1,290,000	1,214,000
1 Yr Teaser 3/6 ARM - 6.1% - 1Yr + 2.75%	1,321,000	1,323,000	1,330,000	1,158,000
1 Mo COPI 2/6 ARM - 6.22% - COPI + 2.4%	1,182,000	1,187,000	1,182,000	1,152,000
1 Mo COPI 2/6 ARM - 5.22% - COPI + 2.4%	1,158,000	1,181,000	1,175,000	1,170,000
Fed Funds - 2.9%	1,051,000	1,142,000	1,221,000	1,231,000
Part B	Value After 3 Years - Fed Funds Rates			
Investment Instrument				
30 Yr FR Mortgage - 7.5%	1,236,000	1,123,000	1,110,000	1,045,000
15 Yr FR Mortgage - 7.1%	1,323,000	1,150,000	1,157,000	1,103,000
10 Yr FR Mortgage - 7.0%	1,197,000	1,171,000	1,180,000	1,154,000
5 Yr Balloon Mortgage - 7.1%	1,258,000	1,307,000	1,222,000	1,207,000
1 Yr Teaser 3/6 ARM - 6.1% - 1Yr + 2.75%	1,181,000	1,173,000	1,156,000	1,136,000
1 Mo COPI 2/6 ARM - 6.22% - COPI + 2.4%	1,153,000	1,180,000	1,175,000	1,170,000
1 Mo COPI 2/6 ARM - 5.22% - COPI + 2.4%	1,147,000	1,150,000	1,201,000	1,201,000
Fed Funds - 2.9%	1,091,000	1,142,000	1,221,000	1,231,000

Figure 3 shows the accumulated total value of cash flows of the various mortgage products under two different reinvestment assumptions. The values shown in Figure 3 Part A assume all of the cash flows are reinvested back into the same type of mortgage instruments while the values shown in Figure 3 Part B assume cash flows are reinvested in Fed Funds. (In the accompanying article, Tom Farin shows how you can utilize a simulation model to generate the cash flows necessary to feed our analysis.) All of the values are greater than the initial \$1,000,000 invested simply because all of the cash flows are being reinvested and are earning enough to overcome the drop in market value from the rising-rate scenarios.

Figure 4 Parts A&B then shows the calculated total rates of return for these values over the three-year holding period for each of the two reinvestment assumptions. For instance, the 30-year FRM generates principal and interest cash flows which when reinvested in mortgages in a flat rate environment and marked-to-market after three years produce a total value of \$1,277,000. This represents a total rate of return of 8.492% for the three-year investment horizon.

Figure 4

Probability Weighted						
Part A						
3-Year TRM - Base Rate	Flat	FR 1-1-1	FR 3-2-1HP	FR 3-1-P	TRM	
Investment Instrument						
30 Yr FR	8.492%	4.004%	5.833%	6.960%	5.617%	
15 Yr FR	7.869%	5.017%	4.800%	2.040%	6.039%	
10 Yr FR	7.491%	5.794%	3.851%	4.789%	6.428%	
5 Yr FR	7.454%	5.017%	7.028%	6.078%	7.130%	
1 Yr ARM-3 Lk	6.982%	8.017%	4.433%	4.467%	6.829%	
1 Yr ARM	5.729%	5.857%	4.800%	4.555%	5.569%	
1 Mo CDFI	5.011%	3.782%	5.433%	6.433%	5.412%	
Fed Funds	2.940%	4.529%	0.800%	0.800%	4.347%	
Probability Distribution - Base Environment	40.00%	45.00%	10.00%	5.00%		

Probability Weighted						
Part B						
3-Year TRM - Fed Funds Rate	Flat	FR 1-1-1	FR 3-2-1HP	FR 3-1-P	TRM	
Investment Instrument						
30 Yr FR Mortgage - 7.5%	7.318%	3.047%	5.019%	3.423%	5.154%	
15 Yr FR Mortgage - 7.1%	6.918%	4.789%	4.801%	3.527%	5.489%	
10 Yr FR Mortgage - 7.0%	6.177%	3.403%	5.910%	4.900%	5.738%	
5 Yr Freddie Mortgage - 7.1%	6.901%	4.473%	6.911%	6.477%	6.928%	
1 Yr Treas 3/0 ARM-3 Yr Lock-5.5%-11Y+2.75%	5.152%	3.403%	3.651%	3.951%	5.242%	
1 Yr Treas 2/0 ARM-4.1%-11Y+2.75%	4.001%	3.791%	5.465%	3.463%	5.304%	
1 Mo CDFI 2/0 ARM-3.22%-CDO+2.4%	4.078%	3.821%	6.200%	6.200%	4.439%	
Fed Funds -- 3.0%	2.940%	4.529%	0.800%	0.800%	4.347%	

A 6% rate shock drops the market value of the 30-year FRM from \$773,000 to \$595,000, reducing the total value of the cash flows from \$1,277,000 to \$1,030,000, and decreasing the TRR from 8.492% to .99%! That's called interest rate risk, folks.

By comparison, the TRR of the 10-year FRM declines from 7.49% to 4.8% in the same scenario. And, *Mama Mia*, look at the TRRs of the two treasury-indexed ARMs- 4.4% on the one-year ARM with the three-year lock-in rate and 4.83% on the straight one-year ARM. That's a fascinating result. When reinvested in a fast-rising rate environment the increased cash flows from a FRM with a faster amortization schedule can produce as much protection from interest rate risk as the repricing capacity of some ARMs. Once again this result is being driven by the impact of annual caps on the ARMs along with the initial teaser rate.

Not surprisingly, the assumption of reinvesting in Fed Funds boosted the TRRs of all the mortgages in the fast-rising rate scenarios, primarily because of the shorter duration of the entire portfolio. On the other hand, the more gentle rate-rise scenario results in greater TRRs when cash flows are reinvested in mortgages.

If you wish you can design your own weighting scheme, assigning different probabilities to alternative interest rate scenarios to come up with a probability-weighted TRR. In the particular forecasts shown in Figure 4, we assigned a 40% probability to a flat rate scenario, a 45% probability to the gentle-rise scenario, and split the remaining 15% between the two fast-rising scenarios. Here's where Noel Fahey employs some sophisticated techniques to forecast probability distributions of interest rates.

You may have heard of the generic term applied to these methods, Monte Carlo analysis. Try not to get hung up on these sophisticated forecasting techniques, they're not critical as long as you employ the same forecasting method across all of your investment choices.

Obviously, the specific results for the various mortgages are a direct function of the origination rate and of the design used to price the mortgage. It is important for mortgage lenders to use the TRR analytical tool to help evaluate and design their mortgages.

No doubt short-term fixed rate mortgages may fill an important need for portfolio lenders who are battling for customer relationships, and struggling to replace refinanced mortgages while carefully budgeting interest rate risk in a mark-to-market world.