

**Problem Set #2 - Understanding Mortgage Prepayments**

(Valuing the Mortgage Call Option and Calculating MPT Cash Flows using PSAs)

1. You have recently been hired by Bilcom Mortgages. One of your first assignments is to value the embedded call option in mortgages. Suppose that the current spot interest rate is 9.5%. Bilcom uses a 1.05 factor for interest rate increases and a .95 factor for interest rate decreases. Your company also assumes that the probability for up (down) is 50% e.g.  $\pi_u = \pi_d = .5$  and periods are 1 year in length. If

Contract Interest Rate: 9.5%

Principal: \$1,000

Term of Loan: 4 years

Refinancing Costs (Points on New Loan): 3 points

Payments Per Annum: 1 payment per year

- a. Generate the five period (Years 0-4) Interest Rate Tree.
  - b. Value the Non-Callable Mortgage Bond. Please show your intermediate mortgage values in a five period "lattice".
  - c. Value the Prepayment (Call) Option on the Callable Mortgage. Please show your intermediate option values in a four period "lattice". Also report what the exercise price is in each of the 5 periods ( $t=0,1,2,3,4$ )
  - d. Value the Callable Mortgage. Please show your intermediate values in a five period "lattice".
2. Calculate the cash flows for the first 30 months to an investor in the following mortgage pass-through

Original Mortgage Balance \$100,000 (in 000s)

Interest Rate 8.5%

Servicing Fee (inclusive of GNMA timing insurance) .5%

Term 360 months

PSA 100%

- a. What would the cash flows for the first 30 months be if the PSA increased to 150%?
- b. What would the cash flows for the first 30 months be if the PSA decreased to 85%?
- c. Graph your cash flows under the various PSAs (100%, 150%, 85%) on the same chart. The y-axis is the cash flows and the x-axis is the months.

d. What would the cash flows for the first 30 months be if you used the following PSA vector:

Month: 1- 15	175% PSA
Month: 16 - 30	100% PSA