Chapter 15: Mortgage Mechanics

Interest-Only vs. Fully Amortizing Loans

- In interest-only loans, the borrower makes periodic payments of interest, then pays the loan balance in full at the end of the loan in a lump sum payment.
- In an amortizing loan, the borrower makes periodic payments of both interest and principal so the loan balance declines gradually over the life of the loan

Understanding the Amortization Process

- With a level, constant payment, the portions of each payment going to interest and principal vary greatly over time.
- The interest portion of each payment decreases over time.
- The principal portion of each payment increases over time.
- The amount outstanding declines to zero at the end of the loan term.

Amortization Example: $100,000 Loan at 10% Interest for 10 years

Year	Payment *PMT*	Interest I_t	Principal P_t	Amount Outstanding AO_t
0	-	-	-	100,000.00
1	$16,274.54	10,000.00	6,274.54	93,725.46
2	$16,274.54	9,372.55	6,901.99	86,823.47
3	$16,274.54	8,682.35	7,592.19	79,231.28
4	$16,274.54	7,923.13	8,351.41	70,879.87
5	$16,274.54	7,087.99	9,186.55	61,693.32
6	$16,274.54	6,169.33	10,105.21	51,588.11
7	$16,274.54	5,158.81	11,115.73	40,472.38
8	$16,274.54	4,047.24	12,227.30	28,245.08
9	$16,274.54	2,824.51	13,450.03	14,795.05
10	$16,274.54	1,479.51	14,795.05	0.00
Total	*$162,745.40*	*$62,745.40*	*$100,000.00*	

To construct an amortization schedule

- Begin by calculating the periodic payment required to amortize the loan using the mortgage payment formula
- Proceed down the rows of the table, one row at a time, by calculating the interest due, subtracting interest from the payment to get principal for the period, and then subtracting the principal paid in the period from the previous years balance to get the new balance

- The following notation will prove useful: PMT = mortgage payment, I_t = interest due in period t, i = periodic interest rate, P_t = principal paid in period t, and AO_t = amount outstanding at the end of period t.

Amortization: Period One

1. $I_t = AO_{t-1} \times i$	10,000 = 100,000 x .10
2. $P_t = PMT - I_t$	6,274.54 = 16,274.54 - 10,000
3. $AO_t = AO_{t-1} - P_t$	93,725.46 = 100,000 - 6,274.54

Amortization: Period Two

1. $I_t = AO_{t-1} \times i$	9,372.55 = 93,725.46 x .10
2. $P_t = PMT - I_t$	6,901.99 = 16,274.54 - 9,372.55
3. $AO_t = AO_{t-1} - P_t$	86,823.47 = 93,725.46 - 6,901.99

Understanding the Fixed Rate Mortgage: Prepayment

- To find the amount needed to prepay (repay before the full term of the loan expires) a loan, use the present value of an annuity formula to find the present value of the remaining payments
- Example: a loan with an original loan amount of $133,000 for 30 years at 7.5% annual interest would require monthly payments of $929.96. At the end of the fifth year of this loan (60 months), the amount outstanding of the original principal amount is $125,841.19.
- Calculator keystrokes shown on page 336.

Understanding the Fixed Rate Mortgage: Refinancing

- Borrowers can take advantage of declining mortgage interest rates by refinancing existing loans at the prevailing market rate. Refinancing the loan at the lower rate reduces borrowing cost by either reducing the payment amount or reducing the number of payments required to amortize the loan.
- Example: Suppose a borrower has an outstanding mortgage loan with a balance of $125,841.19 with 25 years of monthly payments remaining at 7.5% interest. Further suppose that the current interest rate available in the market is 6%.
  - The borrower could refinance the loan for 25 years at 6% and reduce the monthly payment to $810.80
  - Or, the borrower could refinance the loan at 6% interest but keep the monthly payments at $929.96 and reduce the number of months needed to amortize the debt from 300 to 227.
- Calculator keystrokes shown on page 338.

Understanding the Fixed Rate Mortgage: Discount Points and Effective Interest Rates

- Many lenders charge discount points and/or origination fees to increase their yield on mortgage loans.
- One discount point equals 1% of the loan amount.
- Points and fees are paid at origination of the loan.
- From the borrower's perspective, points and fees increase the effective interest rate on the loan.
- Example: Consider a 30-year, fixed rate loan for $100,000 at 7.875% and a "one-half point" due at origination. The monthly payment necessary to amortize this loan is $725.07.

Because the borrower must pay $500 at origination, the effective interest rate is actually higher than the stated rate. Solving for the internal rate of return for the cash flow stream gives an effective interest rate of 7.9275%
- Calculator keystrokes are shown on page 340.
- Repeating this analysis for other loans with different interest rate and discount point combinations allows comparison of the effective interest rates being charged in each loan.

Understanding Fixed Rate Mortgages: Effective Interest Rates with Discount Points and Prepayment
- When a borrower expects to prepay a loan before it is due (as most borrowers do), discount points paid at origination may have a dramatic impact on the effective interest rate of the loan.
- Example: Suppose a borrower is considering a 30-year loan for $100,000 at 7.25% and 3.5 discount points. The monthly payment necessary to amortize this debt is $682.18 and the effective interest rate if the loan is held to maturity is 7.6123%. If the loan is prepaid at the end of the 60^{th} month, however, the effective interest rate increase to 8.1252%
- Calculator keystrokes are shown on page 341.
- The earlier a loan with discount points is prepaid, the greater the effective interest rate for the loan.

Alternatives to the Fixed Rate Mortgage
- Two-step mortgages – loans in which the interest rate is adjusted to match current market rates at the end of the fifth or seventh year
- Adjustable rate mortgages – loans in which the interest rate is adjusted at the end of each year to match current market rates

Two-step Mortgage Example
- Consider a 30-year mortgage for $110,000. The initial interest rate on this loan is 6%, but the loan contract calls for an interest rate adjustment at the end of year seven to 2% above the ten-year U.S. Treasury Bond yield at that time. Assuming that the Treasury yield is 6.9%, the new interest rate for the remaining 23 years of this loan will be 8.9%.
- What is the monthly payment during the first seven years of this loan? $659.51
- What is the monthly payment during the last 23 years of this loan? $840.68
- Calculator keystrokes given on page 343 & 344.

Adjustable Rate Mortgage Example
- Consider a 30-year mortgage for $110,000 that is indexed to the one-year U.S. Treasury Bill yield with a margin of 2%. Further assume that adjustments to the contract rate are limited to 2% annual and 5% over the life of the loan and that the lender offers a teaser of 1% for the first year. Based on the following T-Bill yield forecast, the payments during each of the first four years of the loan are as follows:

Time	T-Bill Yield	Margin	Teaser	Contract Rate	Payment
At origination	4%	2%	-1%	5%	$590.50
At end of first year	5%	2%	0%	7%	$728.44
At end of second year	3%	2%	0%	5%	$593.35
At end of third year	6%	2%	0%	7%	$724.84

- Calculator keystrokes are shown on pages 345 & 346.