Chapter 15
Mortgage Calculations and Decisions

Five Vital Features of a Mortgage

1. Payment
2. Balance (at any point in time)
3. Lender’s yield (internal rate of return), (IRR)
4. Borrower’s effective borrowing cost (EBC)
5. Present value of the debt

Interest Due

- Interest Due is the mirror image of interest earned
- In Principles of Finance you learned that interest earned is:
  - Interest rate \times Amount Deposited
- Interest due is:
  - Interest rate \times Amount Borrowed

Interest Due Example

- You borrowed $250,000 last month at 6 3/8%. How much interest is due now?
  - 250,000 \times \frac{6.375}{1200} = 1328.13
- If you make a payment more than 1328.13, you will be “amortizing” your loan
- If you make a payment less than 1,328.13 you will have negative amortization, or more pleasantly called, positive accrual

Periodic Interest Rate

- The periodic interest rate is the Note Rate divided by the periods per year
- For mortgages, the period is usually one month (12 periods per year)
- The monthly interest rate charged can then be computed as:
  - Rate% \div 1200

Application of payments to loan balances

- Your loan contract will specify the use of payments on your loan. Typically money will first be used to make up any arrears in payments or any penalties you have incurred
- If you are paying according to schedule, your payment will first be applied to interest due
- Any amount of your payment that exceeds the interest due will be used to amortize (pay down) the principal
For the previous Interest Due example, say you made a payment of $1500.
First the 1328.13 interest would be subtracted from your payment and the remaining amount (1500 – 1328.13 = 171.88) would be used to pay down the principal. Your new principal amount would be
250,000.00 – 171.88 = 249,828.12
(See examples for FIN 4713)

If your loan payment and interest rate are constant, your calculator can do the amortization calculations for you.
If your loan payment changes every month, and if the interest rate changes every month, you will need to do a month by month amortization of the loan which allows for these changes.

Calculator hints
Clear the calculator before new problems (Use the C ALL)
Make sure:
The desired number of decimal places are displayed
Set using DISP followed by entering a digit
You have the correct payments (periods) per year
Set by typing a number then press P/YR
Check by holding down C ALL

Calculator hints (continued)
BEGIN indicator is not displayed, unless you are told this problem has beginning of period cash flows
Set using BEG/END
If you have a comma where you should have a decimal point (European notation) then toggle to decimal by:
Toggle using .,/

Notation when using Calculator
What will your loan payment (P&I) be for a $270,000 loan at 6% amortized over a 15 year period
P/YR = 12 (indicate the periods per year)
PMT(PV=-270,000, I/Yr = 6, N=180) = 2278.41
Order of inputs does not matter
Negative sign for PV indicates a cash outflow
N = number of periods
I/YR = stated annual interest rate
The last button one pushes is what you want to solve for: in this case PMT.

Amortization function on Calculator
One sets up the Amortization table in the calculator by entering the starting period and pressing the INPUT key, and then entering the ending period and pressing the AMORT key.
Press the = key to cycle through the principal paid, the interest paid, and the ending balance.
Amortization Example

- For the previous example, how much interest will be paid in the second year?
- First solve for the monthly payment
  \[ \text{PMT}(PV=-270,000, I/Yr = 6, N=180) = 2278.41 \]
- Then:
  - 13 INPUT
  - 24
  - AMORT
- Press the = sign twice to get the interest paid during the second year of 15,182.12

Example 1. Fixed Rate Mortgage (FRM)

- You have applied for a $200,000, 30 yr, FRM, at 4.75%, with three points in lender fees.
- What is your payment?
- How much do you pay in principal in the 14th month?
- How much do you pay in interest in the 14th month?
- What is your loan balance after your 14th payment?
- How much do you pay in principal in the 4th year?
- How much do you pay in interest in the 4th year?
- What is your balance after 4 years?

Lender’s Yield

- Recall there were 3 points on this loan. This increases the lenders yield above the note rate.
- Assuming you keep the loan 360 months, what is the lender’s yield (as an APR)?

Finding the Balance at Any Date

- The balance at any point in the life of a level payment loan is the present value of the remaining contract payments, discounted at the contract interest rate.
- An alternate way to compute the balance at any point in time is to use the amortization function on your calculator. Start by computing the payment on the loan and then you can easily use the AMORT function to compute the balance at any time.

Lender’s Yield – Early Payoff

- Recall there were 3 points on this loan. This increases the lenders yield above the note rate.
- Assuming you keep the loan 48 months, what is the lender’s yield (as an APR)?

Cost to Borrower

- In addition to paying the lender points there are other fees associated with obtaining a mortgage loan.
- What is the cost to the borrower if these 3rd party charges are $1250 and you keep the loan for 30 years?
Special Case of Cost to Borrower – The FTLAPR

- Federal Truth in Lending Act requires disclosure of annual percentage rate (APR) on virtually all home mortgage loans
- FTLAPR: Yield to maturity, after adjusting for:
  - All loan finance charges
  - All compensation to (mortgage) originating brokers
  - All other charges controlled by lender
  - Premiums for any required insurance
- What inadequacy might you see in the FTLAPR as a measure of true borrowing cost?

Federal Truth in Lending APR

Effect of Early Repayment

- What are the effective yield to lender and effective cost to the borrower if you keep the loan four years?

Bullet Loan

- You are purchasing an apartment building for $10,000,000 and have been approved for a 5-year bullet loan at 4.125% in the amount of $7,000,000?
  - What is your monthly payment?
  - How much will you repay at the end of 5 years?

Partially Amortizing Loan

- You purchased a small shopping center for $5,000,000 and have obtained a 4.625% loan that amortizes over a 25-year period, with a balloon payment due on after 6 years. The loan amount is $3,000,000.
  - What is your monthly payment?
  - What is the amount of your balloon payment?

Loan Payoff Mid Month

- On March 1, 2012 you took out a loan for $180,000 that was a 30 year FRM, with an interest rate of 5.25%. What would your loan payoff be on June 21, 2018?
Interaction of EBC, Points, & Holding Period

<table>
<thead>
<tr>
<th>Number of Years Loan Is Outstanding</th>
<th>Discount Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Yrs.</td>
<td>8 Yrs.</td>
</tr>
<tr>
<td>4 Yrs.</td>
<td>10 Yrs.</td>
</tr>
<tr>
<td>30 Yrs.</td>
<td>30 Yrs.</td>
</tr>
<tr>
<td>0.00</td>
<td>0.14%</td>
</tr>
<tr>
<td>0.50</td>
<td>3.11%</td>
</tr>
<tr>
<td>1.00</td>
<td>6.31%</td>
</tr>
<tr>
<td>1.50</td>
<td>9.44%</td>
</tr>
<tr>
<td>2.00</td>
<td>12.5%</td>
</tr>
<tr>
<td>2.50</td>
<td>15.6%</td>
</tr>
</tbody>
</table>

30-year $200,000 fixed-payment mortgage with contract interest rate of 6.0% and other up-front financing costs of $3,000.

Implications?

- Borrowers who expect to move relatively soon should choose to pay few or no discount points & a slightly higher interest rate.
- Borrowers who expect to keep the loan outstanding for a long period should consider paying discount points to buy down the interest rate.

Adjustable Rate Mortgages w/o Caps: Ex 15-3

<table>
<thead>
<tr>
<th>Loan Assumptions</th>
<th>Initial amount: $100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term: 30 years (360 months)</td>
<td>2.75% (275 basis points)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caps: None</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Beginning of Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>3.25%</td>
<td>3.25%</td>
<td>3.50%</td>
</tr>
<tr>
<td>Teaser rate</td>
<td>4.50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest rate</td>
<td>(3.25 + 2.75)</td>
<td>(3.50 + 2.75)</td>
<td></td>
</tr>
<tr>
<td>Loan balance</td>
<td>$100,000</td>
<td>$98,386.77</td>
<td>$97,088.11</td>
</tr>
<tr>
<td>Months remaining</td>
<td>360</td>
<td>348</td>
<td>336</td>
</tr>
<tr>
<td>Monthly payment</td>
<td>$506.69</td>
<td>$507.21</td>
<td>$612.61</td>
</tr>
</tbody>
</table>

Interest rate equals (index + margin) after year 1.

Adjustable Rate Mortgages with Caps: Ex. 5-5

<table>
<thead>
<tr>
<th>Loan Assumptions</th>
<th>Initial amount: $100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term: 30 years (360 months)</td>
<td>2.75% (275 basis points)</td>
</tr>
</tbody>
</table>

| Caps: Periodic (annual): 1.00% | Overall: 5.00% |

<table>
<thead>
<tr>
<th>Beginning of Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>3.25%</td>
<td>3.25%</td>
<td>3.50%</td>
</tr>
<tr>
<td>Teaser rate</td>
<td>4.50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest rate</td>
<td>(3.25 + 2.75) or (4.50 + 1.00)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loan balance</td>
<td>$100,000</td>
<td>$98,386.77</td>
<td>$97,088.11</td>
</tr>
<tr>
<td>Months remaining</td>
<td>360</td>
<td>348</td>
<td>336</td>
</tr>
<tr>
<td>Monthly payment</td>
<td>$506.69</td>
<td>$507.21</td>
<td>$612.61</td>
</tr>
</tbody>
</table>

Overall maximum interest rate 5.00% (4.50 + 1.00).

The END