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

Loan Payment

Annual Payment

- 30 years
- \( \$100,000 \)
- 12 payments

Monthly Payment

- 360 months
- \( \$100,000 \)
- 6/12 payments

What Are a Series of Loan Payments Worth?

- What would the value of these payments be to a lender who can make 6% on other loans?
  - 360 level payments
  - \( \$1,000 \) each

Payment on a Loan

- What would be the payment on the following loan? \( \$166,791.61 \)
  - Level payment
  - 360 months
  - 6% per year

Another Example of Finding a Payment

- Loan amount: \( \$100,000 \)
- Term: 15 years (monthly)
- Interest rate: 6%
- Find the payment for 180 months on a loan that has a present value of \( \$100,000 \)
Finding the Balance at Any Date

- Consider these questions about the previous loan:
  - What is the payment?
  - How much of this is reduction of principal?
  - What balance therefore remains?
  - How many payments now remain?
  - What is the present value of these payment?
- Balance just computed: $99,656.14

PV | PV Pmt | Pmti | in | n | FV
---|-------|------|----|---|----
179 | 6/12  | 843.86 | 0 | 99,656.14

Finding the Balance at Any Date: One More Time

- What is the balance after two payments?
- Principal = $843.86 – Interest reduction = 843.86 – 498.28 (.05 x 99,656.14) = $345.58
- Balance after 2 payments = 99,656.14 – 345.58 = 99,310.56

PV | PV Pmt | Pmti | in | n | FV
---|-------|------|----|---|----
178 | 6/12  | 843.86 | 0 | 99,310.57

Finding the Balance at Any Date: Conclusion

- 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.

Lender's Yield

- Consider the following cash flows:
  - Term 360 months
  - Required yield: 7%
  - Monthly payment: $1,000
- What is the initial loan balance?

PV | PV Pmt | Pmti | in | n | FV
---|-------|------|----|---|----
360 | 7/12  | 1,000 | 0 | 150,307.57

- What if we charge discount points of 3.53%?
  - Points = .0353 x 150,307.57 = 5,307.57
  - Net loan amount = $145,000 ($150,307.57 – 5,307.57)

Effective Borrowing Cost (EBC)

- Third-party expenses: Borrower expenses not paid to lender:
  - Mortgage insurance premium
  - Taxes on the loan
  - Lender’s title insurance
  - Appraisal
  - Survey
- Effect: Borrower receives less than lender's actual disbursement
Effective Borrowing Cost (continued)

- Example: Same loan, but with additional borrower expenses
  - Points: $5,307.57
  - Borrower's loan expenses: $2,692.43
  - Total deducted from loan disbursement: $8,000
    (5,307.57 + 2,692.43)
  - Total net loan: $142,307.57
- What is the implicit interest rate? (term 360 mos., payment $1,000)
  - Net loan amount: $142,307.57
  - Payment: $1,000
  - Interest rate: 7.55%

Special Case of EBC: APR

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

Effect of Prepayment on Lender's Yield and EBC

- Suppose example loan will be prepaid at end of 7 years
  - Loan balance at end of 7 years?
    - Amount: $150,307.57
    - Payment: $1,000
    - Interest rate: 7%
    - Term: 360 mos.

Interaction of EBC, Points, and Holding Period

<table>
<thead>
<tr>
<th>Effective Borrowing Cost</th>
<th>(Assumes 8.5% Interest Rate with 2.00% Other Costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Years Loan is Outstanding</td>
<td>2 Years</td>
</tr>
<tr>
<td>Points</td>
<td>9.61%</td>
</tr>
<tr>
<td>0.00</td>
<td>8.94%</td>
</tr>
<tr>
<td>0.50</td>
<td>9.05%</td>
</tr>
<tr>
<td>1.00</td>
<td>9.17%</td>
</tr>
<tr>
<td>1.50</td>
<td>9.28%</td>
</tr>
<tr>
<td>2.00</td>
<td>9.40%</td>
</tr>
<tr>
<td>2.50</td>
<td>9.51%</td>
</tr>
</tbody>
</table>

Note that the 30-year column is close to the APR.

Borrower Choice

- A lender receives the same yield, assuming the loan is outstanding 7 years, with these two $100,000 loans:
  - Interest rate: 8.5% Or Interest rate: 9.0%
  - Points: 2.50% Points: None
  - Term: 30 years Term: 30 years
- Assuming both loans have $2,000 in other financing costs:
  - Which would a borrower prefer, if moving in 4 years?
  - Which would a borrower prefer, if moving in 15 years?
30-Year Loans vs. 15-Year Loans

| Total Interest on 9% LPM of $90,000 |
|---|---|
| **30-Year** | **15-Year** |
| Monthly payment | $724.16 | $912.84 |
| Total payments (Loan term x pmt) | 260,698 | 164,311 |
| −Principal amortization | 90,000 | 90,000 |
| =Total interest | $170,698 | $74,311 |

Question: Which is the better loan for a borrower?

Present Value Approach to Comparing Loans

- Borrow only when a loan is at least as productive as its interest rate
- Borrow until productivity of additional funds declines to EBC
- For a net-borrower household, EBC approximates the household discount rate (opportunity cost)

Effective Borrowing Cost as the Household Discount Rate

- Usefulness/ Productivity
- EBC
- Household’s Discount Rate vs. Household’s Debt Level Total Household Borrowing

Implications for 30-Year and 15-Year Loans

- What is present value of the 30-year loan of 90,000 at 9% interest rate?
- What is present value of the 15-year loan of $90,000 at 9% interest rate?
- Conclusion: The borrower is indifferent between the loans, assuming:
  - Both loans are at a market interest rate
  - Borrower is unconstrained in borrowing

30-Year Loans vs. 15-Year Loans (continued)

- Choice of two loans: (30-year at 9% and 15-year loan at 8.5%)
- Assume borrower is unconstrained in borrowing
- Which loan would borrower prefer?

30-Year Loans vs. 15-Year Loans (continued)

- Answer:
  - Difference in rates is due to maturity (yield curve)
  - Borrower’s discount rate also should vary by maturity
  - Borrower would again discount each loan at its own interest rate
  - Both loans have a present value equal to face value
  - **Borrower indifferent between them**
30-Year vs. 15-Year Mortgage with Borrower Constrained

- What indicates that borrower is constrained?
  - Borrowing the maximum loan
  - Large credit card balances
- What is borrower’s opportunity cost, or discount rate? At least as high as credit card interest rate on large balances

30-Year vs. 15-Year Mortgage with Borrower Constrained: Answers

- Assumptions:
  - Amount: $90,000
  - Origination costs equal between loans
- 30-Year Loan
  - $57,271.05
- 15-Year Loan
  - $63,323.68

Alternative Amortization Schedules

- Interest-only (straight-term)
  - Seldom with home loans
  - Often with income property loans
- Partially amortized loans
  - Term for maturity
  - Term for amortization
  - "Balloon" payment
- Early Payment
  - Example: “Growing equity mortgage” (GEM)

Adjustable Rate Mortgages without Caps: Exhibit 16-4

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>Index</td>
<td>3.25 Pct.</td>
<td>3.25 Pct.</td>
<td>3.50 Pct.</td>
</tr>
<tr>
<td>Tensor Rate</td>
<td>4.50 Pct.</td>
<td>4.50 Pct. + 2.75%</td>
<td>4.50 Pct. + 2.75%</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>4.5 Pct.</td>
<td>6.00 Pct.*</td>
<td>6.25 Pct.*</td>
</tr>
<tr>
<td>Beginning Balance</td>
<td>$100,000</td>
<td>$98,896.77</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>$546.00</td>
<td>$572.28</td>
<td>$612.97</td>
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</tbody>
</table>

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

Adjustable Rate Mortgages with Caps: Exhibit 16-6

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Tensor Rate</td>
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<td>4.50 Pct. *</td>
</tr>
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<td>6.25 Pct.*</td>
</tr>
<tr>
<td>Beginning Balance</td>
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<td>$98,896.77</td>
<td>$97,088.11</td>
</tr>
<tr>
<td>Months Remaining</td>
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<td>Monthly Payment</td>
<td>$546.00</td>
<td>$566.26</td>
<td>$611.85</td>
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*Interest rate equals (index + margin) after year 1.
Adjustable Rate Mortgages: Recent Variations

- 3 year - 1 year ARM
  - Interest rate fixed for 3 years
  - Adjusts annually thereafter
- 5 year - 1 year ARM
- 7 year - 1 year ARM
- 10 year - 1 year ARM