

The Decision to Refinance

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The Option

- Refinancing should be viewed as an Option which is held by the borrower
- When mortgage rates fall below a borrowers current contract rate it may be profitable to exercise the option
- The decision to refinance is generally an optimal (financial) decision

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What do we need to know?

- Terms of the present loan
  - OMB
- New loan terms
- Costs of Refinancing
  - Costs of both old and new mortgages

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## Costs of Refinancing

- Prepayment Penalties for existing mortgage
- Origination Fees
- Discount Points
- Prepayment penalties on the new mortgage

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## Analytics

- Net Present Value
  - Do the benefits of refinancing exceed the cost?
  - $NPV > \$0$ ; then Refinance
- The benefit of refinancing is the monthly savings associated with refinancing
- The NPV depends upon time until prepayment

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## Example 1

- Suppose a borrower took out a \$100,000 loan (30 yr.) 5 years ago. He paid 2 points and the contract rate was 10%. Current mortgage terms are 4 points with a contract rate of 7%.
- What are the costs of Refinancing?
- What is the NPV assuming the mortgage is held for 25 years?

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### Solution (Costs)

- What is current balance of existing mortgage (\$96,574.32)?
- You must consider the effect of points on the new loan

$$\text{Cost} = \$96,574.32 * .04 = \$3,862.97$$

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### Solution (Benefits)

- What will the new payment be? How much will you save each month?

$$\text{Savings} = \text{PMT}_{\text{old}} - \text{PMT}_{\text{new}}$$

$$\text{PMT}_{\text{new}} = \$682.57$$

$$\text{Savings} = \$877.57 - \$682.57 = \$195.00$$

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### Solution (NPV)

- $\text{NPV} = \$195.00 * \text{PVAF}_{.07/12,300} - \$3,862.97$

$$= \$27,589.95 - \$3,862.97$$

$$= \$23,726.98$$

- How do we use the NPV keys to solve this?

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### IRR

- What is the IRR of the refinancing decision?

$$CF_0 = (\$3,862.97)$$

$$CF_{1-300} = \$195.00$$

$$IRR = 60.57\%$$

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### What about prepayment?

- What is the NPV of refinancing if the mortgage is prepaid 1 year after refinance?
- It is necessary to consider the balances!

$$Bal_{old} = \$95,659.73 \quad Bal_{new} = \$95,096.91$$

$$NPV = \$195.00 * PVA_{F,07/12,12} + \$562.82 * PV_{F,07/12,12} - \$3,862.97$$

$$= \$2,778.52 - \$3,862.97$$

$$= (\$1,084.45)$$

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### Example 2

- Original Mortgage: \$150,000, 11%, 30 yrs 3% prepayment penalty, 3 points (monthly), 5 years old
- New Mortgage: 8%, 4 points, monthly, 5% prepayment penalty
- What are the costs of refinancing?
- What is the NPV of refinancing if the mortgage is prepaid at the end of year 5?

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### Solution (Costs)

- Current penalty to prepay:  
Penalty =  $Bal_5 * .03 = \$4,372.41$
- Points for new mortgage:  
Points =  $Bal_5 * .04 = \$5,829.88$
- Total Cost:  
 $\$10,202.29$

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### Solution (Benefits)

- What is change in monthly payment?  
 $\$1,428.49 - \$1,124.90 = \$303.59$
- What is difference at prepayment?  
 $Bal_{old} = \$138,393.83$   
 $Bal_{new} = \$134,486.47$   
  
Diff =  $\$138,393.83 * 1.03 - \$134,486.47 * 1.05$   
 $= \$1,334.86$

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### Solution (NPV)

$$Cf_0 = (\$10,202.29)$$
$$Cf_{1-59} = \$303.59$$
$$Cf_{60} = \$303.59 + \$1,334.86$$
$$NPV @ 8\% = \$5,666.27$$

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### Variations on the theme

- In the previous problem the mortgage costs are paid up front.
- The mortgage costs can be added to the new mortgage balance so up front costs are zero.
- When analyzing the cash flows in this problem  $Cf_0 = \$0$ , so it is only a PV calculation.

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### Example 3

- Original Mortgage: \$175,000, 12%, 30 yrs, 3 points, 10 years old, 2% penalty
- New Mortgage: 8%, 4 points, 5% prepayment penalty, 20 yrs
- What are the costs of refinancing?
- What is the NPV of refinancing if the mortgage is repaid at the end of year 5?
- Also, assume costs are financed.

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### Solution (Costs)

Old	New
- $PMT_o = \$1,800.07$	- $Bal_o = \$173,421.16$
- $Bal_{120} = \$163,481.49$	- $PMT_n = \$1,450.56$
- $Bal_{180} = \$149,985.00$	- $Bal_{60} = \$151,787.89$

$$Costs = .02 * \$163,481.49 + .04 * (\$163,481.49 * 1.02)$$

$$Costs = \$9,940.08$$

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### Solution (Benefits)

- Savings (Payment)

$$\text{Savings} = \$1,800.07 - \$1,450.56 = \$349.51$$

- Savings (Amortization)

$$Bal_{old} * (1 + PP_{old}) - Bal_{new} * (1 + PP_{new})$$

$$(\$149,985 * 1.02) - (\$151,787.89 * 1.05) = \\ (\$6,392.58)$$

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### Solution (NPV)

$$Cf_0 = \$0$$

$$Cf_{1-59} = \$1,800.07 - \$1,450.56 = \$349.51$$

$$Cf_{60} = \$349.51 + \{Bal_{old} * (1 + PP_{old}) - Bal_{new} * (1 + PP_{new})\} \\ = \$349.51 + \{\$149,985 * 1.02 - \$151,787.89 * 1.05\} \\ = (\$6,043.07)$$

$$NPV_{8\%/12} = \$12,946.52$$

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