Unit 08. Shelter – Section 2

Should You Own or Rent?

- The decision of ownership vs. renting has many aspects, some financial, some non-financial. Here we only consider the financial aspect of this decision.
- The financial aspect of this decision involves considering home ownership as an investment.
- The ultimate question: Are you better off
  - (1) investing in a home, taking the tax benefits, and profiting from potential future appreciation? Or
  - (2) renting, probably spending less money, and being able to invest those saved funds elsewhere?
- The biggest unknown in this comparison is the home appreciation rate. So our task is to figure out how much a house needs to appreciate in order for home ownership to be a better option compared to renting.

- Rephrase the rule of decision:
  - At what average annual rate must a given home appreciate in value in order for home ownership to be preferred as an investment to renting and investing funds elsewhere?
- How to do such a comparison?
  - A seven-step procedure can be used for such a comparison.
  - Because payments are made at different times, we need to use Future Value or Present Value (refer to Unit03 and Unit04) to convert payments so a comparison can be made. While either FV or PV can be used, in this application FV is more convenient.
- A lot of information is needed for such a comparison. In next several slides we will present the information, together with some calculations.

- Holding period = 3 years
- Mortgage information:
  - Purchase price = 200,000
  - Down Payment (20%) = 40,000
  - Loan = 160,000, r = 9%, 30-year fixed
  - Closing cost = 4,000

  - Monthly payment
  - M=160,000/PVFS (r=9%/12, n=360, EOM)= 1287.40
    - See Unit07 for details.
  - Loan balance after 3 years = 156,403
    - This computation requires a spreadsheet application. For this class I will provide the number to you.

- Property tax = 2,000 per year
- Homeowner's insurance = 552 per year
- Operating and maintenance cost
  - 3,000 first year, increase by 20% each year
    - Note operating and maintenance cost usually increases over time as the house gets older and needs more repair and replacement.

- Tax information
  - Federal marginal tax = 25%, State marginal tax = 10%
  - Standard deduction = 5,000
  - Property tax =2,000
  - For annual mortgage interest computation, a spreadsheet application is needed. For this class I will provide the number to you.

- Tax benefits
  - Year 1:
    - year 1 mortgage interest =14355.64
    - tax benefit = (14355.64+2000-5000)*35%=3974
  - Year 2
    - Year 2 mortgage interest =14253.10
    - tax benefit = (14253.10+2000-5000)*35%=3939
  - Year 3
    - Year 3 mortgage interest =14140.94
    - tax benefit = (14140.94+2000-5000)*35%=3899

Slide 7

- Alternative rental information
  - First year rent = 1,000 / month, increase by 5% per year
    - Note rents usually increase every year
- If funds are invested in other financial instruments, interest rate is as follows
  - After-tax interest rate = 6% per year

A Step-by-Step Comparison

- Step 1. How long are you going to stay in this house (holding period)?
  - 3 years
- Step 2. Calculate the FV of the net one-time costs of home ownership.
  - Net one-time costs of home ownership
  - = Down payment + Closing cost
  - = 40,000 + 4,000
  - = 44,000
  - Convert this into FV three years (holding period) later:
  - $FV_1 = \$4,4000 * (1+6\%)^3 = 52,404$

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- Step 3. Calculate the total FV of "net home ownership periodical cost"
  - This figure changes every year so it should be computed and then converted to FV year by year.
  - For each year, net annual home ownership periodical cost
  - = Total ownership periodical cost – Total alternative rent
  - = (Mortgage payment + Property tax + Insurance + Operating and maintenance costs -Tax benefits) - Alternative rent
  - Total FV of net home ownership periodical cost
  - = Sum of (FV of net homeownership cost for each year)

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- Year 1.
  - Total ownership cost
  - = mortgage + property tax + insurance + operating cost – tax benefit
  - = (1287.40*12)+2000+525+3000-3974
  - =15449+2000+525+3000-3974=17000
  - Alternative rent = 1000*12=12000
    - Annual alternative rent = monthly rent * 12 months
  - Net owning cost
  - = Total ownership cost – Alternative rent
  - = 17000-12000=5000
  - FV of Year 1 net owning cost
  - = 5000 *$(1+6\%)^3$=5955
    - Note Year 1 FV conversion n=3

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- Year 2.
  - Total ownership cost
  - = mortgage + property tax + insurance + operating cost – tax benefit
  - = 15449+2000+525+3000*(1+20%)-3939
  - = 15449+2000+525+3600-3939 = 17635
    - Note year 2 operating cost is a 20% increase from year 1
  - Alternative rent = 12000* (1+5%) =12600
    - Note year 2 rent is a 5% increase from year 1.
  - Net owning cost
  - = Total ownership cost – Alternative rent
  - = 17635-12600=5035
  - FV of Year 2 net owning cost
  - = 5035 *$(1+6\%)^2$=5657
    - Note Year 2 future value conversion n=2.

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- Year 3.
  - Total ownership cost
  - = mortgage + property tax + insurance + operating cost – tax benefit
  - = 15449+2000+525+3600*(1+20%)-3899
  - = 15449+2000+525+4320-3899=18395
    - Note year 3 operating cost is a 20% increase from year 2
  - Alternative rent = 12600* (1+5%)=13230
    - Note year 3 rent is a 5% increase from year 2.
  - Net owning cost
  - = Total ownership cost – Alternative rent
  - = 18395-13230=5165
  - FV of Year 3 net owning cost
  - = 5165 *$(1+6\%)^1$=5475
    - Note Year 1 future value conversion n=1.

- For the periodic cost computation it is helpful to construct a table listing all costs.
  - Total FV = FV of net owning for year 1+ FV of net owning for year 2 + FV of net owning for year 3 =5955+5657+5475=17087

		Year 1	Year 2	Year 3	Total FV
Ownership	Mortgage	15,449	15,449	15,449	
	Property Tax	2,000	2,000	2,000	
	Insurance	525	525	525	
	Operating Cost	3,000	3,600	4,320	
	Tax Benef.	(3,974)	(3,939)	(3,899)	
	Total Owning	17,000	17,635	18,395	
Renting	Alternative Rent	12,000	12,600	13,230	
	Net Owning Cost	5,000	5,035	5,165	
	FV of Net Owning	5,955	5,657	5,475	17,087

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- Step 4. Calculate the net outstanding loan balance at the end of holding period.
  - Balance at the end of year three is $156,403
  - This number will be given to you for this class as the computation of it needs an application of spreadsheet.

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AND THIS IS THE SUNKEN LIVING ROOM.

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- Step 5. Sum the results of step 2, 3 and 4, calculate the required breakeven selling price with realtor's commission (In this case we assume 6% realtor's commission) taken into consideration.
  - Breakeven selling price
  - = (FV of one-time net ownership cost + FV of periodic net ownership cost + loan balance at the end) / (1-realtor commission rate)
  - = (52,405+17,087+156,403) / (1-6%)
  - = 225,895/0.94 = 240,313

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- Step 6. Find the breakeven annual rate of housing value appreciation.
  - Denote the appreciation rate as A
    - $200,000 * (1+A)^3 = 240,313$
    - Solve for A: $A = (240,313/200,000)^{(1/3)}-1=6.31\%$

- Step 7. Compare the calculated breakeven rate of housing value appreciation to forecast of housing value appreciation.
  - If the expected annual rate of appreciation is > 6.31% than buying a house is a better deal. Otherwise, renting is a better deal in this example.

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Some General Conclusions Regarding Own vs. Rent

- Home-buying is preferred to renting
  - The higher the marginal tax rate
    - This increases the tax benefit and thus decreases the periodical cost of home ownership
  - The hotter the rental market
    - This increases the alternative rents and thus decreases the net homeownership cost.
  - The lower the mortgage rates
    - This decreases mortgage payments and thus decreases the periodical cost of homeownership
  - The longer the holding period
    - The FV of periodical cost of ownership tends to decrease over time.

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How Much of a Downpayment Should You Make?

- By now you should know how much downpayment you make will depend on the opportunity cost you face. The higher interest rate you can earn from your alternative investments, the lower of a downpayment you should make. However, one needs to compensate for the risk you face in alternative investments.
- Usually it is a good idea to have at least 20% downpayment to avoid private mortgage insurance, which can be upward to $200 a month.
- Private mortgage insurance protects the lender in case you cannot fulfill your mortgage payment obligation. It is required for a conventional loan with a downpayment of less than 20%.

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How Much Home Can You Afford?

- How much home you can afford depends on the size of your mortgage loan you can afford. Lenders qualify you using a criterion called PITI ratio.
- What is PITI?
  - Principal (P)
  - Interest (I)
  - Tax (T)
  - Insurance (I)
    - Note principal + interest = mortgage payment
- PITI Example:
  - Monthly payment = 1,287
  - Monthly insurance = 552/12=46
  - Monthly property tax = 2,000/12=167
  - PITI=1,287+46+167=1,500

- What is PITI ratio?
  - PITI ratio = PITI / monthly gross income
  - If monthly gross income = 72,000 / 12 = 6,000, then
  - PITI ratio = PITI / monthly gross income = 1,500/6,000 = 25%
- How to take other debts into consideration?
  - (PITI +other debt payments)/monthly gross income
  - Example:
    - Monthly car payment = $400
    - (PITI+other debt payments) ratio = (1500+400)/6000=1,900/6,000=31.7%
- What are the rules of qualification?
  - Rule 1: PITI/monthly gross income <= 28%
  - Rule 2: (PITI +other debt payments) / monthly gross income <= 38%
- Does the consumer in the previous example qualify?
  - Rule 1: 25% < 28%, yes
  - Rule 2: 31.7% < 38%, yes
- You can figure out the maximum PITI monthly payment you can afford.
  - Example: Suppose your monthly gross income is $5000, using a 28% PITI ratio, what is the maximum monthly PITI payment can you afford?
  - 5000*28%=1,400

An Overview of Mortgages

- Two conventional forms:
  - Conventional fixed rate mortgages (30 years, 15 years, etc.)
  - Adjustable rate mortgages
- Other products – there are numerous mortgage products on the market these days. We will cover a few as examples in this class. Note that all mortgage products follow the same principle, in that the present value of all future payments should equal to the loan amount. Remember there is no free lunch.
  - Interest only mortgage
  - Graduated payment mortgage
  - Biweekly mortgage
  - Balloon/reset mortgage

Conventional Fixed-Rate Mortgages

- Conventional fixed rate mortgages have fixed interest rate and fixed monthly payments. The most common type is 30-year fixed. There are 15-year fixed and 10-year fixed. At the other end these days you may also see 40-year fixed rate mortgages. Here we look at the mortgage payments for a 30-year and a 15-year fixed rate mortgage. Typically the shorter the term, the lower the interest rate.
- Here is a loan of $160,000. If 30 years, interest rate is 9%. If 15 years, interest rate is 8.75%.
  - 30-year fixed
    - M=160,000/PVFS(rm=9%/12, n=360, EOM)=1,287.40
  - 15-year fixed
    - M=160,000/PVFS(rm=8.75%/12, n=180, EOM)=1,599.12

Adjustable Rate Mortgages (ARM)

- What is adjustable rate mortgage (ARM)?
  - With an ARM the mortgage interest rate and your monthly payment can be adjusted up or down over time.

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"As an alternative to the traditional 30-year mortgage, we also offer an interest-only mortgage, balloon mortgage, reverse mortgage, upside down mortgage, inside out mortgage, loop-de-loop mortgage, and the spinning double axel mortgage with a triple lutz."

- Important ARM terms
  - Index: The index is a market interest rate which is not directly controlled by the lender and which the lender uses to adjust for the ARM interest rate. The index is published in the newspaper and on the Internet.
    - Example: T-Bill index, Libor index, COFI index
  - Spread/Margin: The spread is the amount which, when added to the Index, produces the ARM interest rate.
    - Typically the spread/margin is 2.75% to 3%.
  - Rate cap: Rate caps put limits on the changes in the ARM interest rate. These caps work on both increase and decrease of the interest rate. Usually rate cap has two numbers, one being the cap for each change period, the other for life time of the loan.
    - Example: 2/6 – meaning that for each rate change period, the maximum rate increase or decrease is 2%. Over the life time of the loan, the maximum rate increase or decrease is 6%.
  - Frequency of rate and payment change: How often the interest rate and monthly payment will change. Typically the rate and the payment change at the same time.
    - Example: 1 year, 6 months, 1 month
  - Teaser rate: the initial low interest rate for the first period

ARM Computations

- Mortgage scenario:
  - 30-year ARM
  - Teaser rate = 6%; Frequency of rate/payment change = 1 year
  - Index = T-Bill index; Cap = 2/6, meaning that over the life time of the loan the rate can never be lower than 0% or higher than 12%.
  - Spread = 3%
  - Loan amount is 160,000
- Year 1: T-bill index =10%
  - Index does not matter for the first period. Only teaser rate matters. r=teaser rate=6%
  - $M_1 = 160,000/PVFS (rm=6\%/12, n=360$ months, EOM$)=959.28$
  - Loan balance at the end of year 1= 158,035.18

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- Year 2
  - T-Bill index=7%, cap=4%~8%, r could be 7%+3%=10% but outside the cap (4%~8%). So r is restricted at the top of the cap at 8%
  - $M_2 = 158,035.18 /PVFS(rm=8\%/12, n=348$ months$)=1,169.37$
  - Loan balance at the end of year 2 = 156,593.39
- Year 3
  - T-Bill index=6%, cap=6%~10%, r could be 6%+3%=9% within the cap (6%~10%) so r=9%
  - $M_3=156,593.39/PVFS(rm=9\%/12, n=336$ months$)=1,279.09$
- Year 4 …

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Interest Only Mortgages

- The interest-only feature allows borrowers to make lower payments on a fixed-rate mortgage by offering an interest-only period during the early years of the loan, followed by a fully amortizing period.
  - Note that the monthly payment after the initial interest-only period will be higher than a conventional mortgage.

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- Example Scenario
  - L=160,000, r=9%, 30-year fixed
  - First three years interest only
- Payment structure:
  - First three years, monthly payment $M=L*rm=160000*(9\%/12)=1200$
    - Note this is less than the 1287.40 for a 30-year conventional mortgage. Loan balance remains the same as there is no principal payment.
  - From year 4, monthly payment
  - $M=L/PVFS(rm=9\%/12, n=324)$ $=160000/121.488172=1317.00$
    - Note the number of months remains is 12*27=324

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Graduated Payment Mortgage

- Payments start low then gradually rises for 3-5 years, then levels.
- This type of mortgage is good for consumers with low current income but has good potential for increased future income.
- Needs to be careful about negative amortization in the first several years
  - Negative amortization means your loan balance actually increases instead of decreases.

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- Example Scenario
  - L=160,000, r=9%, 30-year fixed
  - First three years graduated payment mortgage. Payment can be determined by the bank or you or negotiated between you and the bank.
- Payment structure:
  - Year 1: $800/month
    - At 9% interest rate the first month interest payment is $160000*(9\%/12)=1200$
    - So you have a deficit of $400. This is added to your mortgage balance. So you new balance after one month is 160000+400=160,400. This is negative amortization.
    - For month 2 interest you owe is $160400*(9\%/12)=1203$. You have a deficit of $403. Your new balance after two months is 160,803.
    - So on and so forth
    - With spreadsheet computation one can compute that at the end of year 1, the mortgage balance is 165,003. You owe about $5000 more than you started.

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- Year 2: Monthly payment =1000
  - Still negative amortization. By the end of year two your mortgage balance is 167,974.
- Year 3: Monthly payment = 1200
  - Still negative amortization. By the end of year three your mortgage balance is 168,722.
- Year 4 and on: payments normalized.
  - M=168,722/PVFS (rm=9%/12, n=324, EOM)=168,722/121.488172=1388.79

Balloon/Reset Mortgage

- Balloon/Reset Mortgages are mortgages with a conditional refinancing option after the initial period is over, usually 5 or 7 years.
- For the first 5 or 7 years monthly payments are based on a 30-year amortization.
- The conditional refinancing option allows borrowers to refinance after 5 or 7 years with a 25- or 23-year fixed-rate mortgage, provided that the borrowers qualify.
- These products are good for consumers who are pretty sure they are going to sell the house after 5 to 7 years as they might be able to get a lower interest rate on these than 30-year fixed rate mortgage. However, these can be a problem for some consumers who want to keep the house but cannot qualify for the refinancing option after 5 or 7 years. They may lose their house as a result.

Biweekly Mortgage

- Biweekly Mortgages are similar to traditional fixed-rate, level-payment, fully amortizing mortgages, except the borrower's payments are made every 14 days (payment is half of regular monthly payment) instead of once a month.
- Because you actually pay 13 regular monthly payments (one year has 52 weeks, you pay 26 half-monthly payments), Biweekly Mortgage will be paid off much sooner than a conventional mortgage, resulting in significant interest savings over the life of the loan.
- The example we have been using (30-year fixed, 9% interest rate for 160000 loan) can be paid off in about 22 years with a biweekly payment of $643.70 (half of 1287.40).

Concluding Remarks Regarding Mortgages

- There are numerous mortgage products in the market. We only covered a few of these options. The textbook covered some more examples. New products are coming out every year.
- The key is to understand the principle of mortgage payment structure, in that the present value of all future payments should equal to the mortgage loan. If you pay less now, you will pay more later. There is no way around it. So beware of mortgage products that sound too good to be true!