Mortgage Calculation Class Handout

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Note: As requested by a previous group, I will provide a hand out of the overhead sheets next week. This document is not the sheets. I put this together as a reference in case you need it after the class.

Mortgage Calculations Overview

Finance Terms

Commitment: Agreement between a lender and an investor. The investor agrees to purchase a certain amount of loans by a certain date at a certain price or yield. There are 2 kinds of commitments—mandatory and optional.

Securitization: The process of taking multiple assets and pooling them together into a new security sometime called a pass-through security.

Face Value: The amount the issuer contracts to repay (bonds). For mortgages the face value is usually the loan amount.

Par: Price of 100 percent of face value.

Price: The amount that an investor pays for an asset (loan). Usually expressed as a relationship between the amounts paid for the asset and the face value of that asset. If sold 'at par' the price is 100. An 'overpar' price could be 102 while an 'underpar' price could be 98.

Yield: The ratio of investment income to the total amount invested over a given period of time. Usually expressed in terms of an percentage over a one year period. Yield can also be considered the actual rate of return of an income producing investment.

Example: What is the yield to an investor if he buys a fixed rate loan for a price of 98 and a note rate of 9%.

> The borrower pays 9% of the par value (100) in interest. Therefore the investor receives 9 in cash flow for an investment of 98. Therefore the yield to the investor is 9 divided by 98 which is equal to 0.091836 i.e. approximately 9.18%.

Future Value: The value of a fixed amount at a definite time in the future given a specified interest rate.

Present Value: The current value of an amount received at fixed point in the future given a certain discount (interest) rate.

Relationship between PV, FV, i and n.

$$FV_{i,n} = PV(1+i)^n$$

$$PV_{i,n} = FV(1+i)^{-n}$$

$$n = \frac{\text{Log (FV/PV)}}{\text{Log (1+I)}}$$

The above formulas are used to find present and future values of an amount at one point in time. However, the present value (or future value) of different amounts at various periods of time is simply the sum of each of the present values.

For example: someone promises to pay you $500 one year from now, $200 two years from now and $300 three years from now. Assuming your opportunity cost or discount rate is 10%. What is the present value of the series of cash flows.

The present value of these payments will be the sum of each of the present values.

Present Value of $500 one year from now =	500/(1.10)^1	=	454.55
Present Value of $200 two years from now =	200/(1.10)^2	=	165.29
Present Value of $300 three years from now =	300/(1.10)^3	=	225.39
Total Present Value			845.23

Similar to the above there is a special type of sequence of payments, which involve fixed payments at regular intervals of time. These series of payments are called **Annuities,** and, given that they have fixed payments at regular intervals of time, the above formulas can be simplified into one formula that calculates the present value of an annuity (derivation of the formula is not shown):

$$PVA = ANN \quad \frac{1-(1+I)^{-n}}{I}$$

In the above formula, PVA is the present value of a series of payments (ANN). A fixed rate mortgage loan is nothing more than an annuity of payments made at the end of each period. In mortgage terms ANN is considered the mortgage payment consisting of principal and interest, commonly called the P&I or PI, whereas PVA is the loan amount. Since the loan amount is usually know and calculated, solving for ANN would give you the mortgage payment (P&I).

Principal and Interest Payment (P&I):

From the above section, solving for ANN and changing the name ANN to PI and PVA to LA (Loan Amount) we get:

$$PI = LA \quad \frac{I}{1-(1+I)^{-n}}.$$

(Note: to use the formulas, annualized interest rates have to be converted to periodic interest rates. That is for monthly payment loans divide the annual interest rate by 12. For example for a 12% annual rate i = .12/12 = .01)

Amortization
In general amortizing a loan means applying payments periodically to pay accrued interest and reduce the loan balance. The P&I as calculated above is a unique amount that will cause the loan to amortize to a balance of 0 in exactly n periods. Although this is mathematically correct, for real world applications the P&I is usually rounded to 2 decimal places. Given this, an adjustments needs to be made to the last payment (either up or down) in order to get a 0 balance after n periods.

Putting this another way, the total present value obtained if we discount each P&I payment (applying Present Value formulas discussed earlier) using the discount rate I for n years would give us the loan amount. As stated earlier the loan amount is nothing more than the present value of the series of P&I payments.

Non Interest Credit Closing: Occurs when the borrower pays interim interest from the date of closing until the end of the month.

Interest Credit Closing: Occurs when the borrower is credited with interest from the beginning of the month until the date of closing. This assumes the first P&I payment will be made the 1st of the following month.

Example of fixed rate
Amortization

Loan amount	$ 65,000.00	Payment	$ 570.43
Term	$ 360.00		
Note Rate	0.10		

PMT #	Payment	Principal	Interest	Rate	Bal to Due
					$65,000.00
1	$570.43	$28.76	$541.67	10.000%	$64,971.24
2	$570.43	$29.00	$541.43	10.000%	$64,942.24
3	$570.43	$29.24	$541.19	10.000%	$64,913.00
4	$570.43	$29.49	$540.94	10.000%	$64,883.51
5	$570.43	$29.73	$540.70	10.000%	$64,853.78
6	$570.43	$29.98	$540.45	10.000%	$64,823.80
7	$570.43	$30.23	$540.20	10.000%	$64,793.57
8	$570.43	$30.48	$539.95	10.000%	$64,763.09
9	$570.43	$30.74	$539.69	10.000%	$64,732.35
10	$570.43	$30.99	$539.44	10.000%	$64,701.36
11	$570.43	$31.25	$539.18	10.000%	$64,670.11
12	$570.43	$31.51	$538.92	10.000%	$64,638.60

Non Fixed Rate Loans

These loans take on many forms, the most common of them being ARMs, GPMs and RRMs. The basic premises of these loans are that the interest rate and/or the amount of payments can change over time. If the payments do not adjust in relation to the interest the loan may not amortize over the n periods. ARM loans will be discussed in more detail later.

Qualification

In order to obtain a mortgage loan both the property and the needs to qualify.

Property Analysis (Appraisal's, LTV etc. will be discussed)

Borrower Analysis:

In order to qualify for most loans the lender looks at 2 fundamental attributes of the borrower. One is the ability to repay the loan, and the second is the willingness to repay. Willingness to repay is more subjectively determined by looking at the borrowers past credit history usually with the help of a credit report. Housing and Debt ratios are used as guidelines to indicate ability to repay.
(See attached sheets titled Mortgage Loan Origination put together by Lance)

Mortgage Insurance

In order to hedge against the risk against bad loans against a property that might be worth less than the loan, investors require mortgage insurance on certain loans with high loan to value ratios. This insurance is similar to other insurance in that one has to pay insurance premiums in order to receive a certain amount of coverage. However depending on the type of loan there are various ways the insurance can be paid.

For Conventional loans private mortgage insurance companies have various methods in which premiums can be paid. The simplest way is to pay a single insurance premium upfront which is usually an insurer defined percentage of the loan amount. The lender may allow this amount to be added to the base loan amount that the borrower requested thereby 'financing' the mortgage insurance premium.

Other methods of calculating PMI payments are using insurer defined tables. With this method various percentages are used against the loan amount for specified number of months. Foe example, premiums for a $100,000 loan –

	Percent	Number of Months	Monthly Premium
Initial Percentage	.52	12	43.33
First Renewal	.40	108	33.33
Second Renewal	.30	240	25.00

The monthly premiums are calculated by multiplying the Loan Amount by the Percent and then dividing by 12. e.g. 100,000* .0052/12 = 43.33.

The above method is referred to as level monthly MI because the premiums are based on a 'level' amount i.e. the loan amount.

Another method similar to the above is one where the premium is based on the annual declining principal balance of the loan. With this method, the appropriate percent is applied to the remaining principal balance after every 12 month period. This amount is good for the subsequent 12 months.

VA Funding Fee

The insurance premium used for VA loans is called the VA funding fee. There are no monthly premiums for VA loans. The fee is based on a 'Funding Fee Percentage', which is determined by VA and are dependent on the Veterans status, amount of down payment and purpose of the loan.

MIP for FHA loans

The premiums used for FHA loans are called risk based premiums and are determined by HUD. FHA loans have both an upfront premium as well as a monthly premium. The percentages are based on the term of the loan and the loan to value ratio. The longer the term and higher the LTV the greater are the percentages used to calculate the premiums and the longer the time the monthly premiums have to be paid (hence the term risk based).

The upfront portion of the MIP premium is similar to the single premium in a conventional loan in that it is a percentage multiplied by the loan amount. This amount can be financed into the loan.
The monthly premium however is calculated based on the monthly declining balance, and then averaging the premiums every 12 months.

Foe example:

Bal to Date	**05%MIP**
$65,000.00	
$64,971.24	27.08
$64,942.24	27.07
$64,913.00	27.06
$64,883.51	27.05
$64,853.78	27.03
$64,823.80	27.02
$64,793.57	27.01
$64,763.09	27.00
$64,732.35	26.98
$64,701.36	26.97
$64,670.11	26.96
$64,638.60	26.95

Average for the first 12 months = $24.76 which will be used as the monthly premium for those payments.

Adjustable Rate Mortgages

This is the most common type of non fixed rate loan. With these loans the interest rate and payments change based on an 'index' that is market derived and not under the control of the lender or borrower. The loan starts at an 'initial interest rate' and then the contract specifies certain times when the interest and payment can change. The actual rate charged is calculated by adding a predetermined 'margin' to the current index subject to maximum and minimum caps. Usually the initial rate is good for a certain time period and thereafter the rate is good for the first 5 years and thereafter adjusts every year. In addition to the values needed for a fixed rate loan following values are needed to calculate payments for a regular ARM loan.

Index: Refers to a market determined rate like a T-Bill rate, Prime Rate, FHLB index etc. Expressed as a percentage.

Margin: A percentage value that is added to the index to determine the next interest rate for the loan.

Period Cap: The maximum increment that the rate can increase or decrease during any one change period. Also expressed as a percentage. (Could have different upward and downward caps)

Life Cap: The maximum increment that the rate can increase or decrease during the life of the loan. (Could have separate upward and downward caps). If there is a life cap there need not be a life rate.

Life Rate: The maximum or minimum rate that is allowed for the loan. This is an actual rate as against and increment. If there is a Life Rate there cannot be a life cap. (In our calculations the life rate takes precedence over the life cap i.e. if a life rate is present the calculation will ignore the life cap.

The servicing department is responsible for applying the correct interest and payment adjustments to the loan and informing borrowers about payment changes. However, at the time of origination the terms of the ARM loan have to be disclosed. The truth in Lending regulations require that we estimate the payments that the borrower makes and from those payments determine the APR (discussed earlier). In the case of ARM loans we do not know what the index will be in the future, therefore the regulations say that we should disclose interest and payment changes up to the Fully Indexed Accrual Rate (FIAR). The FIAR is the rate determined by what the index is at present. The FIAR is usually more than the initial rate since the initial rate offered is generally lower than the market rate and called the **teaser rate**.

FIAR = Current Index + Margin

For the purpose of the C calculations we limit the FIAR by the Life Cap or Life Rate of the loan. By doing this, when we figure payment adjustments up to the FIAR, the life caps have already been accounted for.

Once the FIAR has been determined we can begin to amortize the loan. The amortization works similar to a fixed rate amortization until we reach a payment adjustment month. At a payment adjustment month, the new rate is calculated by adding (or subtracting) the period cap from the current rate that is in effect a move toward the FIAR. Then a new P&I amount is calculated using the new rate and the remaining term of the loan. This process is repeated at each subsequent change periods until the FIAR is reached. Once the FIAR is reached, the interest rate and payment stays constant for the remaining term of the loan.

NOTE:
For disclosure purposes we show payment changes until the rate reaches the FIAR. That is NOT necessarily the 'worst case' scenario.

For a normal ARM loan as described above the loan will amortize to 0 in exactly n periods as specified at the start of the term. The reason for this is that each time there is an interest rate change there is a P&I change and the P&I is calculated using the PI formula with the current remaining balance for LA and the remaining months for n.

Other Variable Rate Mortgages

GPM's, Step loans, RRM, will be discussed.

Temporary Buydowns

A buydown is a mechanism that is used to lower the borrowers monthly payments for a specific period of time. This can be done by subtracting a predetermine dollar amount from each of the monthly payments. This amount usually is reduced every 6 months or one year. The amount of the buydown can either be ‘stated’ as a dollar amount or it can be determined from an interest rate subsidy. An interest rate subsidy is usually specified by a percentage amount that will be subtracted from the borrowers note rate in order to calculate a new P&I. The rate obtained after subtracting the interest rate subsidy from the note rates rate is called the bought down rate. The difference between the P&I at the note rate and the P&I at the bought down rate is the monthly benefit received by the borrower. This monthly difference is paid every month to the investor such that the investor still receives the whole P&I at the note rate.

Although the buydown requires monthly payments, the lender generally collects an amount upfront from the person sponsoring the buydown. The amount is deposited into an interest bearing escrow account. Then the lender using money from the account to make the monthly payments. The amount that is put into the escrow account is the total present value of all the assistance payments discounted at the rate of interest (i) that the escrow account pays. (We will go over this using the attached example).