Behavioral and Personal Finance
Prof. Abhijeet Chandra
Vinod Gupta School of Management
Indian Institute of Technology, Kharagpur

Module – 02
Personal Finance
Lecture – 35
Loans and Amortization

Hi dear. Continuing with previous session, where we discussed about Consumer Credit as a source of financing for individuals and household, when it comes to consumer purchase decisions. We will talk about another alternative of source of money or source of finance for individuals that is basically loans and how we can understand the basic mathematics of loans to make better financial decisions. This session talks about Loans and Amortization, basically we will in this particular session, we will try to understand the basics of loans as a source of money for individuals and households.

And what are the factors that must be considered for making a decision with respect to loans and their amortization. I guess you must have heard of the rule of 72. Well, the rule of 72 says that if you divide 72 by the rate of interest, this will tell you the number of years which your money will take to double, which means if you are investing your money somewhere and you are getting a rate of return that is basically the rate of interest that you are going to receive on your deposits or an investment and you use this rule of 72, you should be able to know how much time or how many years should it take for your money to grow and turn into double the money that you have invested.

For example, if you invest your money in avenues which is going to give you 5 percent rate of return which is basically rate of interest and you follow this the rule of 72, which I was just mentioning this will indicate that 72 divided by 5 which is basically 14.4. So, it this number indicates that in 14, 14.4 years or in little more than 14 years your money should be growing

into double the amount that you have invested. Well, that is just one simple rule which is based on certain assumptions and it tells you that the number of years it should take for your money to grow into double is given by this rule of 72.

Another similar rule is the rule of 78. Well, we will discuss about the rule of 78 later on. For now, we will try to understand what are such simple basic mathematical understanding, when it comes to the decision making with respect to loans that we take as part of our financial planning and financial decision making and the amortization process which is basically nothing but repayment process of the loan so that after the tenure is over, the loan amount is 0.

(Refer Slide Time: 03:52)

First of all, we try to understand what the loan is and what are the basic generic features. So, basically loans are the amount that we borrow from different sources and this amount is repaid in different installments and this installment comprises of interest as well as the principal

payment. For example, if we borrow money from bank or any other financial institution, today we have to make payment periodically and that payment in different periods could be monthly or annually and this payment amount should include interest charges that are defined in the beginning itself and the principal amount or the part of principal amount that is basically the amount of money that we have taken as loan.

As discussed earlier loans are taken from lenders and the person or individuals who take that money are known as borrowers, who pay the amount of loan in different installments which is basically periodic payments that comprises of interest and the principal amount. Loans can be taken for mortgage basically housing loans, car loans, personal loans and so on. Similarly, the amount of money that is charged in terms of interest could be compounding in terms of simple compounding or simple interest or compounding interest. The basic mathematics explains that compounding interest is definitely more complicated than simple interest charge on the loan that we borrow.

Another feature of loans is although not necessary, but typically the principal, the payment intervals and the dates for which payments are made in terms of how often and when are you making the payment of interest and principal amount, coincide with the interest compounding intervals and dates. Basically, if it is a monthly installment or monthly compounding loan that you have borrowed, the repayment period and interval will also be monthly. The interest rate that is basically the charges of borrowing loan is calculated on the money that you have owed for the past month and it has nothing to do with the payment that you are about to make. So, when you understand the interest that has calculated from the overdue amount.

The amount that has been owed by you and it does not have any reflection on the expected payment or the future payment. Having understood this basic feature of a loan, let us try to understand how compounding of interest matters in terms of payment of loan and the future of the loan process, the loan making process. Here, I have tried to explain an example with the simple numbers.

So, suppose that you have borrowed a loan or you have taken a loan of 30,000 rupees which has an annual interest rate of 8 percent compounding on a monthly basis and the tenure of the loan is 4 months. So, basically loan amount is 30000, tenure is 4 years and since it is compounding monthly number of months that has been compounded in this particular scenario is 48 months. Annual interest rate is 8 percent which is basically 0.08. Since, it is monthly compounding interest, we know that monthly compounding interest will be divided by 12 and the rate of interest that we are being charged for this loan is 0.006666.

So, the monthly interest that we the person who has taken this loan will be paying is 0.0066 into the amount of money that has been borrowed; so, 200 rupees of monthly interest being paid. If it is simple interest loan, then you pay 200 rupees per month on the loan amount that you have taken and total in amount that you might be paying will be 9600. If it is compounded

monthly over the period of the tenure of the loan, then the calculation might be slightly different.

(Refer Slide Time: 08:54)

So, here I have taken the numbers to one step ahead. The example is same we have borrowed a money of 30000 rupees for 4 years which is basically 48 months at the rate of 8 percent annual interest, compounded math monthly that is the rate of interest that is charged on a monthly basis is 0.6666 percent. So, in period 1 which is basically starting from next period here, the amount of interest being due is 200 rupees because the loan amount previous month or previous period is 30000.

So, the balance in loan account will be 30000 plus 200. So, the total balance as at the end of period one will be 30,200 and interest that is charged on this amount at the rate of 0.6666 percent will be accumulated over next period as 201 rupees 33 paisa that will be added to this

particular amount. So, total amount due at the end of second period will be 30401.33. Now, similarly, the interest will be charged on this amount to the extent of 0.6666 percent that will lead us to the interest payment calculated on this amount for next period that is 202.68 and so on.

So, this is how we calculate the monthly compounding of interest at the rate 0.6666 percent on the amount balance in loan account. So, if you see that the loan amount that was taken on 0 day to the extent of 30000 rupees and compounding monthly at the rate of interest 8 percent per annum. The amount of money that will be due till the end of 48th month that is end of 4 years 41,269.98. So, essentially, if you reduce this amount of loan that you have taken, the amount of interest that you are paying is basically 11269.98 in terms of compounded interest.

So, this is a simple example of how loan interest is charged on the balance of previous period, balance in loan account or in the previous period and this is calculated monthly or the periodically at which it is compounded. Now, since loan is taken and every month you are committed or you are liable to pay certain amount of money back to the lender, the numbers might look slightly different. So, the numbers that will look when you have some amount of money to be paid every month will be as follows.

(Refer Slide Time: 12:21)

Suppose, you decide to make a payment of 200 rupees every month. So, you take the same loan 8 percent per annum. So, 30000 rupees of loan for 4 years 8 percent per annum compounded monthly that is interest will be charged on 0.6666 percent. So, 200 rupees every month you are paying. So, at the end of first compounding interval, the interest due is 200 rupees that is basically 0.666 percent of this amount. So, 200 rupees you pay 200 that balances out. So, the amount left at the end of one period is 30000. Next month again interest is calculated on the basis of 0.6666 percent on this amount, you paid off 200, 30000. Again, interest is calculated on this amount and so on.

Your balance in loan account will always be 30000 because you have paid the interest charges every month. You are paying just enough to cover the interest charges and that is why the balance in loan account in this scenario is always 30000. Now, one of the simple examples of this particular type will be a scenario, where individual buys a new house before selling the old

house. So, if you look at this example, where the individual buys a new house before selling the old house to reduce the monthly expenses, he will pay the interest charges every month till the time he sells off the old house.

And the moment he says the old house, he can pay this principal amount from the sales proceed of the old house and thereby, closes the loan. Closes basically when he sells of the old house, he will get a substantial amount of money. So, he closes the loan account by using that money. So, this is another example, where we can understand how loan can be paid off periodically, just in case of interest only payments scenario. Another example is when you try to pay more than what the interest charges are.

(Refer Slide Time: 15:25)

So, in this scenario, I try to explain interest and principal payment. Suppose, the scenario is same 30000 loan account, 4 years that is a 48 months, 8 percent interest rate, monthly

compounding at 0.6666 percent and at the end of first compounding interval, the interest charges are due on the balance of the previous month that is 30000 into 0.6666 percent which is almost 200 rupees. But you decide to pay 300.

Now, out of this 300; 200 will be going towards interest payment and remaining 100 will be going towards principal payment. So, when you pay 300 rupees as your monthly payment; 200 will be charged towards interest and remaining 100 will be charged towards principal which means at the end of one period, the principal amount will be reduced by this 100 rupees that you have paid towards principal. So, your effective principal amount at the end of first period will become 29100 which is the case here. For next period, the interest will be charged on this 29100 at the rate of 0.6666 percent and that is why it is less than 200 rupees.

So, every period, you pay 300 that is higher than the interest charges due and your principal amount starts decreasing. Similarly, your interest charges also start decreasing. So, that is why it is suggested that the larger the payment amount you pay, the better it is because it will also reduce the interest charges as a result of lower principal amount. Now, let us try to expand the same make this example to one stepead.

Now, suppose that we have a scenario, where the payment amount is 732000.39 paisa. Case is same 30000 of loan, 4 years of tenure, 8 percent annual interest rate, monthly compounded at 0.6666 percent. Now, here the monthly payment goes to the lender inter in 1 installment of 732 rupees 39 paisa, which means for every 732 rupees 39 paisa of payment basically 200 is going towards interest in the first month, remaining 532.39 is going towards principal payment. And subsequently, this amount of principal that is balanced in loan account keeps on decreasing and subsequent as a result, the interest charges also keeps on decreasing.

So, when you look carefully at the end of 4 years which is at the end of 48th month, the amount of interest that has been charged on the previous months balance that is 727 rupees 41 paisa, it is just 4 rupee 85 paisa and the remaining 727.5 actually goes towards paying the principal and thereby, principal amount has become 0. So, the thing that is highlighted here is in first payment interest component was 200; whereas, in last payment the interest component

was 404 rupee 85 paisa. So, we have seen that over the period, the interest component has gone down as a result of the principal amount going down because more of the money that that have been paid over every months has gone towards principal amount due.

So, that is how the loans are paid off when the charges or the amount of payment that has been paid to the lender by the borrower is more than the interest due on that in particular loan account. This particular process is known as amortization. Basically, it indicates the process through which the loan amount is reduced to nil over the period.

(Refer Slide Time: 21:03)
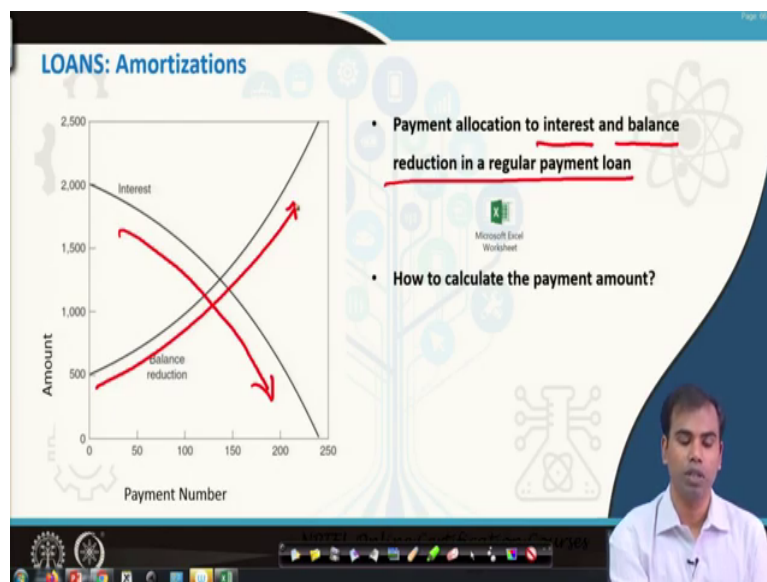
And if we try to understand this in a more generalized way, we know that every payment that has been made towards on the loan account by the borrower includes a interest payment as well as the balance towards the regular payment loan. And this essentially shows that for a longer period time, the amount of interest that is going to be considered will reduce as we

have seen, you can see that the amount of interest that has been gone towards the interest payment is reduced and the balance reduction is upward because more of the money for from every payment is going towards recovery of the main loan balance account. If you try to look this through a more calculated numbers, it is shown here.

(Refer Slide Time: 22:08)
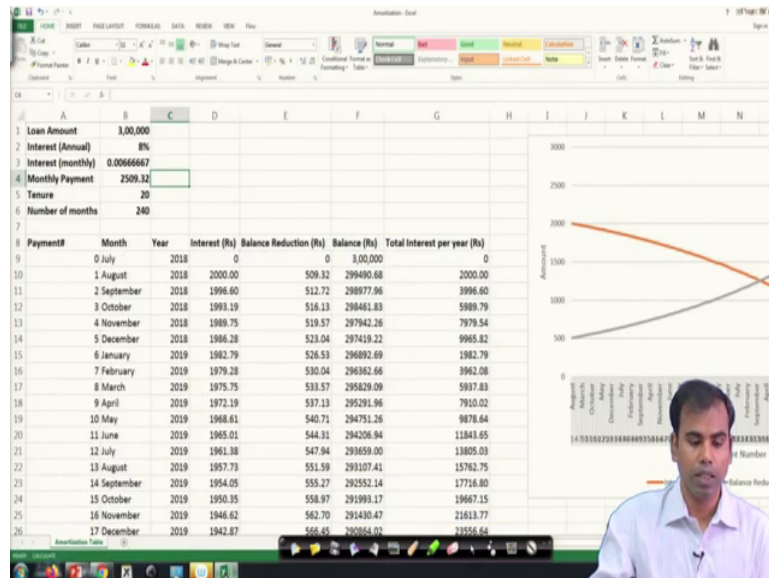
If we look at this particular example, this is an example of the loan that has been to the extent of 300000 rupees. So, if you see here this is 300000 rupee of loan that is taken and interest charged is 8 percent, interest monthly charged because it is compounded monthly is 0.0066. So, monthly payment is basically 2509 rupee 35 paisa, tenure is 20 years which converted into month becomes 240. So, if that loan is taken on in July 2018. We know that the amount of money that has been paid is not changing. So, for every month after that month 2509 rupees 32 paisa was paid as payment. Out of which in the first month 2000 rupee was paid towards interest and 509 rupee 32 paisa was paid towards reduction in balance.

So, basically this 2000 is the interest charged on the due loan account. So, loan account here is 300000 lakh rupees, loan interest charges is 0.006666. So, this amount has been calculated using this principal amount into the percentage of interest charged on that loan overdue. So, this will give us 2000 rupees and this is basically the EMI that has been paid, the amount that has been paid minus the interest charges and this is basically the principal amount minus contribution towards balance reduction and that is how every month, it is growing the amount that is going towards balance reduction.

So, when we try to calculate this number over the year. So, this is since this is a 24, 20 years tenured loan which is 240 months. The calculation is shown here and we know that the amount that we have been paying every year is also changing. So, in first year the total interest that has been paid for first six months is 9965 rupee 82 paisa. And if you try to see for other number, other years the balance is balanced reduction is going and balance is substantially decreasing over the months to the extent of the total balance amount becoming 0 at the end of 20 years.

(Refer Slide Time: 25:11)

	B	C	D	E	F	G	H	I
103	May	2026	1564.48	944.84	233726.68	7884.54		
104	June	2026	1558.18	951.14	232775.54	9442.72		
105	July	2026	1551.84	957.48	231818.05	10994.56		
106	August	2026	1545.45	963.87	230854.19	12540.01		
107	September	2026	1539.03	970.29	229883.89	14079.04		
108	October	2026	1532.56	976.76	228907.13	15611.60		
109	November	2026	1526.05	983.27	227923.86	17137.65		
110	December	2026	1519.49	989.83	226934.03	18657.14		
111	January	2027	1512.89	996.43	225937.61	1512.89		
112	February	2027	1506.25	1003.07	224934.54	3019.14		
113	March	2027	1499.56	1009.76	223924.78	4518.71		
114	April	2027	1492.83	1016.49	222908.29	6011.54		
115	May	2027	1486.06	1023.26	221885.03	7497.60		
116	June	2027	1479.23	1030.09	220854.94	8976.83		
117	July	2027	1472.37	1036.95	219817.99	10449.19		
118	August	2027	1465.45	1043.87	218774.12	11914.65		

(Refer Slide Time: 25:16)

|	B	C	D	E	F	G	H	I
85	November	2024	1670.99	838.33	249809.49	18680.21		
86	December	2024	1665.40	843.92	248965.56	20345.60		
87	January	2025	1659.77	849.55	248116.01	1659.77		
88	February	2025	1654.11	855.21	247260.80	3313.88		
89	March	2025	1648.41	860.91	246399.89	4962.28		
90	April	2025	1642.67	866.65	245533.23	6604.95		
91	May	2025	1636.89	872.43	244660.80	8241.84		
92	June	2025	1631.07	878.25	243782.55	9872.91		
93	July	2025	1625.22	884.10	242898.45	11498.13		
94	August	2025	1619.32	890.00	242008.45	13117.45		
95	September	2025	1613.39	895.93	241112.52	14730.84		
96	October	2025	1607.42	901.90	240210.62	16338.26		
97	November	2025	1601.40	907.92	239302.70	17939.66		
98	December	2025	1595.35	913.97	238388.74	19535.01		
99	January	2026	1589.26	920.06	237468.67	1589.26		
100	February	2026	1583.12	926.20	236542.48	3172.38		

And every year there is amount of money that has been paid towards interest. So, for let us say in 20-25 December, the amount of my interest that has been paid was total towards 19535.

(Refer Slide Time: 25:39)

|	B	C	D	E	F	G	H	I
235	May	2037	238.04	2271.28	33434.79	1339.63		
236	June	2037	222.90	2286.42	31148.37	1562.52		
237	July	2037	207.66	2301.66	28846.71	1770.18		
238	August	2037	192.31	2317.01	26529.70	1962.49		
239	September	2037	176.86	2332.46	24197.24	2139.36		
240	October	2037	161.31	2348.01	21849.24	2300.67		
241	November	2037	145.66	2363.66	19485.58	2446.33		
242	December	2037	129.90	2379.42	17106.16	2576.24		
243	January	2038	114.04	2395.28	14710.89	114.04		
244	February	2038	98.07	2411.25	12299.64	212.11		
245	March	2038	82.00	2427.32	9872.32	294.11		
246	April	2038	65.82	2443.50	7428.81	359.93		
247	May	2038	49.53	2459.79	4969.02	409.45		
248	June	2038	33.13	2476.19	2492.82	442.58		
249	July	2038	16.62	2492.70	0.12	459.20		
250								

So, this particular spreadsheet example shows that at the end of 20 year that is 240 months, the total amount charged towards interest was 16 rupees 62 paisa and the remaining amount of 2592 or 32 paisa is going towards reduction in balance. And thereby, the total balance becoming almost 0. So, if we try to plot this example, the graph that we get is basically the same graph that we were trying to understand which shows that the amount of interest going to the interest component is reducing.

(Refer Slide Time: 26:05)
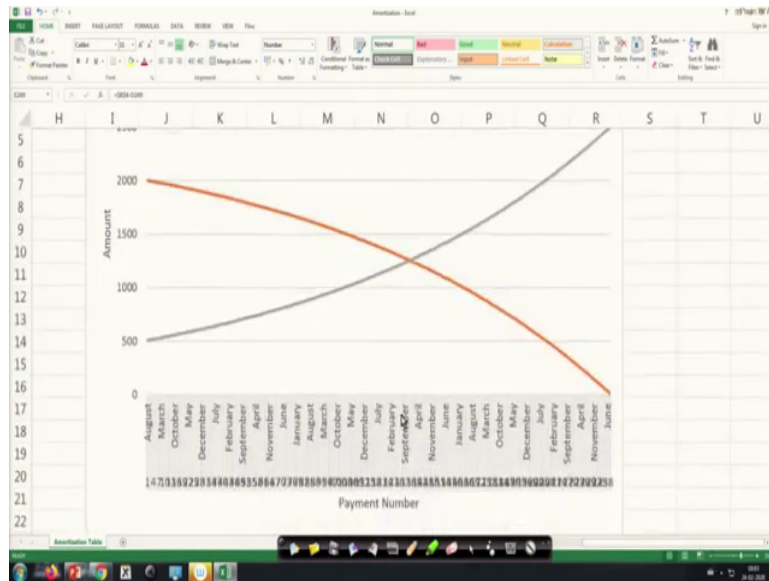
And the amount of money going towards balance reduction is increasing over the period. This particular example shows this, but this relationship between the amount of money going towards interest and the amount of money going towards balance reduction.
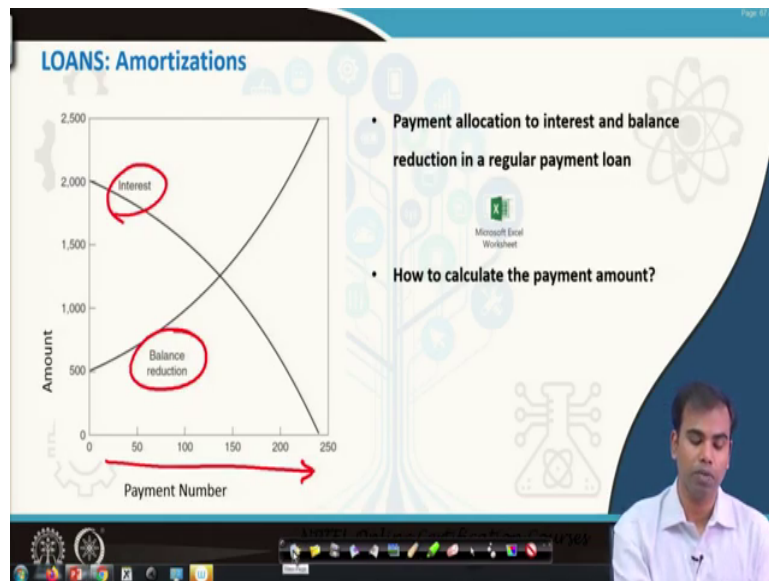
They have negative relationship and if it is very long period loan, it substantially changes the amount of money going towards interest payment at the later part of the tenure.

So, in this session, we have understood that loans are basically amount of money borrowed by individuals for different purposes and it is important to understand whether loans are compounded monthly or semi annually or annually because the compounding determines the amount of money that has been paid by the borrowers to the lender and it also determines the component of which basically interest are charged to and the principal amount has been reduced to subsequently in nil.

The amount basically paid by borrowers to the lender includes principal amount and interest payment and compounding schedule determines the extent to which principal amount has been taken away from the payment schedule. One example that has been discussed here shows that there is always a predetermined number or value of payment that has been discussed here. For example, if you try to see these three examples. So, here the amount of money was 7300 sorry

732 rupees 39 paisa. If you try to see previous examples here, the amount of money that was going was 300 rupees. In previous example, the amount of money that was paid was 200.

So, basically in all three examples that we discussed here, we essentially understood that the amount of money that is going towards payment was given. Now, the question comes here how do we arrive at this number of 732 rupee 39 paisa or any amount that is going towards payment because that amount only includes interest payment and part recovery of the loan balance account. So, in next session, we will try to understand, how these amount of payment is arrived at. Because that is most important to understand how the loan has been repaid off in terms of interest payment and the principal payment. For now, this is it.

Thank you very much.