

## Interest Rates and Self-Sufficiency

### LESSON 2



### NOMINAL, EFFECTIVE AND REAL INTEREST RATES

Understanding interest rates for microenterprise lending requires knowledge of a few financial terms, concepts, and formulas. This lesson discusses basic types of interest rates and their methods of calculation.

#### Interest Rates and Their Uses

Rate	Definition	Use
Nominal	Quoted rate of interest on a loan.	To calculate interest due on a loan.
Effective	Actual rate that borrower pays for a loan, including interest, fees, and commissions.	To determine and compare total financial cost of loans.
Real	Either the nominal or effective rate adjusted to compensate for inflation.	To determine whether the effective or nominal rate charged is sufficient to compensate for devaluation of the loan fund due to inflation.

#### Nominal Rates of Interest

**Nominal rates of interest** on a loan are the rates the lender states the borrower will pay. Most financial institutions quote nominal rates on an annual basis. Because microenterprise loans frequently have terms of less than a year, nominal interest rates are often quoted on a monthly basis.

Nominal interest rates are used to calculate the amount of interest to be paid on a loan. The amount of interest to be paid for a loan depends on the nominal interest rate, the amount borrowed, and the time period. For example, a loan of \$1,000 to be repaid in one year at 9 percent annual interest would mean that the borrower pays back the \$1,000 in principal at the end of one year, plus \$90 in interest ( $1,000 \times .09 \times 1$  year). Because this loan is paid back in one payment of principal and interest, the interest calculation is referred to as **simple interest**.

#### Amortized Loans

Most microenterprise loans are **instalment** or **amortized** loans, however, meaning that equal, periodic (such as weekly or monthly) payments of principal and interest are made throughout the life of the loan. To figure out the interest payments for amortized loans, the nominal interest rate is multiplied by the **amount of principal outstanding** (the **declining balance**) for each payment period.

*Amortized loans are paid in equal, periodic payments of principal and interest over the life of the loan.*

### **AMORTIZATION SCHEDULE**

The following amortization schedule shows the payments to be made on a three-month, \$100 loan with a nominal interest rate of 2 percent per month. Lesson 4 shows how nominal interest rates are used to calculate the monthly payment amount and construct the amortization schedule.

*Example 1*

Month	Interest payments \$	Principal Payments (\$)	Total Payments (\$)	Balance (\$)
				100.00
1	$(100.00 \times 0.02) = \$2.00$	+ 32.68 =	34.68	67.32
2	$(67.32 \times 0.02) = \$1.35$	+ 33.33 =	34.68	33.99
3	$(33.99 \times 0.02) = \$0.68$	+ 33.99 =	34.68	0.00
	Total \$4.03	+ 100.00 =	104.03	

Although nominal rates are quoted by financial institutions, in most cases they do not accurately portray the financial costs of a loan. What if the loan described above carries a 3 percent commission in addition to the 2 percent interest charge? Or, what if the lender calculates the interest payments each month by multiplying the nominal interest rate times the original loan amount instead of times the outstanding balance?

In these cases, the borrower pays more than 2 percent for the loan. In other words, the borrower effectively pays a rate higher than the nominal interest rate. When the borrower pays a rate different from the nominal interest rate, then the effective interest rate must be calculated to figure out the actual financial costs of the loan.

### **INTEREST ON THE ORIGINAL LOAN AMOUNT**

Using the original loan amount (sometimes referred to as flat interest), the amount of interest that the borrower pays during each payment period equals the nominal interest rate times the original loan amount, no matter what the outstanding balance of the loan is during the period.

*Example 2*

Month	Interest payments \$	Principal Payments (\$)	Total Payments (\$)	Balance (\$)
				100.00
1	$(100.00 \times 0.02) = \$2.00$	+ 33.33 =	35.33	66.67
2	$(100.00 \times 0.02) = \$2.00$	+ 33.33 =	35.33	33.34
3	$(100.00 \times 0.02) = \$2.00$	+ 33.34 =	35.34	0.00
	Total \$6.00	+ 100.00 =	106.00	

For each payment, the borrower pays 2 percent of the original loan amount (\$100) in interest, and one-third of the original loan amount in principal. The borrower pays \$6 in interest for this loan, compared to \$4.03 when interest was calculated on the declining balance.

Charging flat interest means that the borrower pays interest on the original loan amount (\$100) for three months, even though he owes substantially less than \$100 of principal for two of those months. As the loan term lengthens, the interest costs of flat interest loans become far greater than for loans calculated using the declining balance, and the rate actually paid becomes far higher than the nominal interest rate.

Some microenterprise credit programs use flat interest because it facilitates the calculation of the amortization schedule, is easy for borrowers to understand, and the program earns more than its quoted nominal interest rate. Flat interest calculations are generally not considered acceptable for formal financial institutions, however, as they are considered misleading to the borrower.

### Effective Rates of Interest

*Effective interest rates show the ratio of the total financial costs of a loan, considering interest, fees and the calculation method, to the principal amount that the borrower uses.*

Effective rates of interest bring all of the direct financial costs of a loan together in one interest rate. Effective interest rates incorporate interest, fees, the calculation method, and other loan requirements into the financial cost of the loan. Effective rates can be compared to determine whether the conditions of one loan make it more expensive or less expensive to the borrower than the conditions of another loan.

When interest is calculated on a declining balance, and there are no additional costs to a loan (as in the example in *Example 1*), the effective interest rate is the same as the nominal interest rate. Most financial institutions, however, use an interest rate and fee structure that make the effective interest rate on their loans higher than their nominal rate. Their reasoning may be a desire to have lower nominal interest rates, a strategy to cover the costs of a specific service (such as loan monitoring) with a specific fee, or a system for generating income upon loan disbursement.

Effective interest rates will differ from nominal rates whenever a different method of calculation is used, or there are additional financial costs, such as:

- a. The interest being calculated based on the original loan amount instead of the outstanding balance.

This flat method of calculation is commonly used by informal lenders and some microenterprise credit programs. The effective monthly interest rate of the loan in *Example 2* is not the stated nominal rate of 2 percent, but 2.97 percent. The borrower pays \$6 in interest instead of \$4.03. As the loan term increases, the effective rate of loans calculated with flat interest becomes increasingly larger than the nominal rate.

- b. The interest being deducted ("discounted") from the original loan amount before the loan is disbursed.

For a three-month, \$100 loan at 2 percent, the borrower pays a total of \$4.03 in interest (as in *Example 1*). That \$4.03 is deducted from the amount the borrower receives. The borrower receives \$95.97, but pays interest on the entire \$100. The

monthly effective interest rate is 2.08 percent, even though the nominal rate is 2 percent. The effective interest rate on discounted loans becomes increasingly larger than the nominal rate as the loan term increases.

c. A commission or other fee.

Fees will alter the effective interest rate to varying degrees depending on how they are calculated and paid. For example, if the bank charges a 5 percent fee on the loan in *Example 1*, payable upon loan disbursement, then the borrower receives a \$100 loan, but has to pay \$5 right away. The borrower pays interest on \$100, but only gets to use \$95. The effective monthly interest rate on the loan is 4.68 percent, more than double the nominal rate of 2 percent. Unlike the previous cases, the effective interest rate on loans with fees decreases as the loan term increases, because the cost of those fees is spread out over more payment periods.

d. A requirement that the borrower maintain a minimum amount, a compensating balance, in a savings account in order to receive a loan.

Compensating balances are a common practice of credit unions and some microenterprise programs. The borrower in *Example 1* might be required to place \$25 on deposit in a savings account to receive a loan for \$100. Effectively, the borrower receives a \$100 loan, pays interest on \$100, but has \$25 of his own money tied up without being able to use it to generate income. The monthly effective interest rate is 4.3 percent.

*The higher the effective interest rate, the more this loan is actually costing the borrower, and the more it is earning the lender.*

As the examples above show, a three-month loan advertised at 2 percent monthly interest can have an effective interest rate considerably higher than 2 percent. The higher the effective interest rate, the more this loan is actually costing the borrower, and the more it is earning the lender. All of these types of interest calculations are used, underscoring how little nominal interest rates reveal about the costs of a loan. The only way to ascertain the true financial costs of loans and compare the costs of loans from different lenders is by using the **effective interest rate**.

### Calculating Effective Interest Rates

The effective interest rate represents the total financial cost of a loan to the borrower, considering the conditions of the loan (as in the four examples above). For loans with only one payment at the end, **simple interest loans**, calculating the effective interest rate is easy. The effective interest rate is the amount the borrower pays in interest, fees, and commissions, divided by the amount the borrower receives.

$$\text{Effective Interest Rate} = \frac{\text{amount paid in interest, fees and commissions}}{\text{principal amount received by borrower}}$$

For example, the effective interest rate (EIR) of a \$100 simple interest loan at 2 percent per month, with a 5 percent fee paid upon loan disbursement, is:

$$\begin{aligned} \text{EIR} &= \frac{(\$100 \times 0.06 \text{ interest}) + (\$100 \times 0.05 \text{ fee})}{(\$100 - \$5 \text{ fee})} \\ &= 11.6\% \text{ for three months or } 3.9\% \text{ per month} \end{aligned}$$

Calculating the effective interest rate for amortized loans is more complicated because the amount on which the interest payments are calculated (the amount of principal outstanding) is different for each payment period. A rough approximation of the effective interest rate can be calculated by dividing the interest, fees, and commissions on the loan by the sum of the amounts outstanding during the loan period. The result is the effective interest rate per payment period.

$$EIR = \frac{\text{amount paid in interest, fees and commissions}}{\text{sum of principal amounts outstanding}}$$

For example an approximation of the effective interest rate of a \$100 amortized loan with monthly payments, a monthly nominal interest rate of 2 percent and a 5 percent commission paid upon loan disbursement is:

$$EIR = \frac{4.03 \text{ interest}^1 + (0.05 \times 100 \text{ fee})}{(100 + 66.67 + 33.34)}$$

$$EIR = 4.5\% \text{ per month.}$$

<sup>1</sup> See Example 1 for calculation of amount of interest

The easiest way to accurately calculate effective interest rates, however, is to use a spreadsheet. The spreadsheet can be set up to calculate the effective rate when provided with the **amount the borrower receives** (sometimes called **present value [PV]**), the **number of payment periods (N)**, and the **amount to be paid in each period (PMT, often entered as a negative number)**. These three variables change depending upon the conditions of the loan. The following example shows how these variables are used to determine the effective interest rate of an amortized loan with a commission.

### *Example 3:* USING A SPREADSHEET TO CALCULATE EFFECTIVE INTEREST RATES

To calculate the effective interest rate of a \$100, 3-month loan with a nominal interest rate of 2 percent per month and a commission of 5 percent paid upon loan disbursement:

1. Determine the monthly payment:

- a) Enter into the spreadsheet the loan amount, the number of payment periods and the nominal monthly interest rate:

$$\begin{aligned} PV &= 100 \\ N &= 3 \\ i &= 2 \end{aligned}$$

- b) Solve for payment:  $PMT = -34.68$ .

2. Determine the effective interest rate:

- a) Enter into the spreadsheet the monthly payment, the amount the borrower effectively received and the number of payment periods:

$$\begin{aligned} PMT &= -34.68 \\ PV &= 95 \text{ (\$100 minus 5\% of \$100)} \\ N &= 3 \end{aligned}$$

- b) Solve for effective interest rate:  $i = 4.7\%$  (per month).

Lesson 4 shows how to use a spreadsheet for loans with flat interest, interest deducted up front, and compensating balances. A spreadsheet is attached to this study guide, which you can use to make these calculations.

It is important to realize that the effective interest rates of loans with the same nominal interest rate and fee can vary with the loan size and loan term. A three-month, \$100 loan at 2 percent per month, with a 5 percent fee paid up front, has an effective rate of interest of 4.7 percent per month (see above for calculation). The same loan over a six month period has an effective rate of 3.5 percent per month. If the fee is a set amount, instead of a percentage of the loan amount, then the effective rate will change considerably as the size of the loan increases or decreases as well.

### Real Rates of Interest

*The real rate of interest is the rate of interest adjusted to allow for inflation and is the interest rate minus the rate of inflation.*

Real rates of interest are rates that have been adjusted to compensate for the effects of inflation. Real interest rates are either nominal or effective rates of interest minus the inflation rate. They can be either **positive** or **negative**. For instance, if an institution charges an effective rate of 45 percent annually in an economy where inflation is 24 percent a year, then the real effective rate of interest is 21 percent (45 - 24). If only 20 percent interest is charged, then the real effective rate is negative 4 percent. Real rates of interest are important analytical tools for managers who must ensure that they do not let inflation eat away the value of their lending portfolios. With negative-real rates of interest, the value of a loan portfolio cannot be maintained.

### THE EFFECTS OF INFLATION

The effects of inflation on the value of a portfolio can be calculated with the following formula, where  $VP_f$  is the value of the portfolio at the end of the period,  $VP_i$  the value of the portfolio at the beginning of the period, and  $i$  the rate of inflation of the period:

$$VP_f = \frac{VP_i}{(1+i)}$$

In Colombia, during the period from 1980 to 1988, the average annual rate of inflation was 24 percent. If a credit program had a portfolio in Colombian pesos worth US\$ 100,000 in 1985, and neither lost nor added any new money to the portfolio through 1987, then the change in value of the portfolio during the three-year period would have been:

Year	Value of Beginning Portfolio (\$)	Value of Ending Portfolio (\$)	Value Lost to Inflation (\$)
1985	100,000	80,645	19,353
1986	80,645	65,036	15,609
1987	65,036	52,488	12,588

By 1988, the pesos in the portfolio would have been worth only \$52,448! To preserve the value of its portfolio, the program would have to generate enough income to add the amount shown in the "Value Lost to Inflation" column to its portfolio each year. In 1985,

approximately 20 percent ( $19,355/100,000 = 19.4$  percent) interest would have to be earned on the portfolio just to replace the value lost that year.

Negative real interest rates are common in highly inflationary environments, especially if government policies control interest rates. Negative rates create great incentives to borrow because, in effect, the borrower pays back less (in value) than what he borrowed.

Subtracting the inflation rate from the interest rate produces an approximation of the real interest rate. As inflation increases, however, this approximation becomes less accurate and the following formula should be used:

$$\text{real interest rate} = \frac{(1 + \text{nominal interest rate})}{(1 + \text{inflation rate})} - 1$$

In order to control the negative effects that high rates of inflation can have on financial systems, some countries index loans. The loans are not denominated in a specific currency, like pesos, but rather in a non monetary unit that is pegged to inflation. This non monetary unit, such as the *unidad de poder adquisitivo constante* in Colombia (UPAC: constant purchasing unit) is a "value unit" pegged to a specified "basket" of goods and services that is used to measure inflation. The UPAC is, in essence, a monetary unit that reflects inflation. In Colombia, interest rates for long-term loans (mostly for housing) are always expressed as UPACs plus a nominal interest rate.