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Calculating Interest on Savings

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Savers receive payment in the form of interest earned on deposits in return for allowing the savings institution use of their funds. While many microfinance institutions (MFIs) are becoming computerized, and have automatic calculations of interest or dividends on savings, there are still many institutions that are not automated; they calculate interest and maintain their general and subsidiary ledgers manually. This tool is intended for savings institutions that operate with manual systems. The instructions that follow can also be used to explain to clients how interest is earned on their passbook savings and term deposits.

While this tool focuses on the calculation of interest rates once the rates have been set, it is important to note here that officials should exercise caution when establishing the interest rates to be paid on savings. If an institution promises to pay an interest rate that it cannot meet, clients will lose confidence in the institution. When the institution loses credibility, clients are likely to withdraw their savings. Mass savings withdrawals could cause a crisis in the institution.

Accrued Interest Payable

Most institutions in developing countries use cash accounting. In other words, they recognize income when the cash is actually received and expenses when they are actually paid. This often means that they are not recognizing the interest owed to clients on their savings (or dividends owed to members in credit unions). For many credit unions, this worked fine in the past, since they only paid dividends on shares at the end of the year and offered the most basic of savings and loan products.

Today's savings institutions need to be conservative in their operations: they should not accrue the interest on loans, but they should accrue (recognize) the interest due to clients on savings. Savers expect returns on their deposits and savings institutions today offer a variety of savings products, which are rate sensitive (meaning that the funds will leave the institution if it does not pay competitive rates). As a result, the accrued interest payable is becoming a significant liability. Institutions need to recognize this liability by accruing the interest due to clients, particularly if the interest is a contractual obligation of the institution. In addition, credit unions should estimate and accrue the anticipated dividend that will be paid on member shares at the end of the operating year.

The interest on savings (and dividends on shares in credit unions) should be shown as expenses in the Statement of Income. Interest (and dividends) should be recorded as current charges in the fiscal period to which they apply.

Common mistakes to avoid. Savings institutions in some countries do not recognize the liability until the term deposits mature or are withdrawn; as a result, an institution could be insolvent and not even know it. Some credit unions do not recognize the dividends in the proper fiscal period; because the dividend was declared after the end of the year, they place the dividends in the following year. This is incorrect. The expense needs to be recognized in the operating year in which it was incurred.

Accounting Entries for the Interest on Savings

Interest must be shown as an expense in the Statement of Income for the period to which it applies. Interest should be recorded as of the close of the applicable interest period by a debit to the *Interest Expense* account and a credit to the *Interest Payable* account.

When the interest liability credited to the *Interest Payable* account is liquidated, the account should be debited and the offsetting credit should be to the *Cash* or *Savings* accounts. The *Interest Payable* account should be used only at the end of the period to reflect the actual or estimated amount of interest that is due and payable to clients.

Savings institutions that accrue interest expenses on a more frequent basis than the actual interest period should record the liability in the *Accrued Interest Payable* account. For example, an institution that declares and pays quarterly interest but accrues interest expenses monthly would record the liability in the *Accrued Interest Payable* account in between the actual interest periods (in cases where the interest is not credited to clients' accounts until the month following the end of the interest period). On financial statements for the months at the end of each interest period (quarterly: March, June, September, and December), the liability should be transferred from the *Accrued Interest Payable* account to the *Interest Payable* account.

Where the interest is credited to clients' savings accounts on the last day of the period, the entry should be a debit to *Accrued Interest Payable* account and a credit to *Savings*. The financial report for the end of the quarter should have no balance in the *Interest Payable* or *Accrued Interest Payable* accounts.

Entries in the Journal and Cash Record

All entries affecting these accounts should be recorded as *Miscellaneous* in the Journal and Cash Record.

Example Entries

The following entries are used to record the estimated interest liability for the months of July, August, and September when the institution is on a quarterly interest period and interests are credited to clients' savings accounts on the first day of the next interest period (assuming one type of savings).

a. The following entries would be made at the end of each month:

Dr.-Interest Expense	$1,000	
Cr.-Accrued Interest Payable		$1,000

The balance of the *Accrued Interest Payable* would be $3,000 at the end of September.

b. When the interest is distributed to clients' accounts on September 30, and the actual amount of the interest is $2,900:

Dr.-Accrued Interest Payable	$3,000	
Cr.-Savings		$2,900
Cr.-Interest Expense		$100

c. If we use the same examples as (a) above, except that interests are credited to clients' accounts on the first day following the end of the interest period, entries for each month would be the same as (a) above:

Dr.-Interest Expense	$1,000	
Cr.-Accrued Interest Payable		$1,000

d. To record the interest payable as of September 30 for example (c) above:

Dr.-Accrued Interest Payable	$3,000	
Dr.-Interests Payable		$3,000

e. When Interest for (c) and (d) above is credited to clients' accounts on October 1, and the actual interest amounts to $2,900:

Dr.-Interest Payable	$3,000	
Cr.-Savings		$2,900
Cr.-Interest Expense		$100

Detail of Transactions
CREDITS

1. To record the amount of interest either declared or estimated during an accounting period;
2. With the excess of actual interest, if any, over the amount previously recorded.

DEBITS

1. To liquidate the amount of interest liability upon distribution to clients;
2. With the amount or difference, if any, between the accrued amount and the actual amount of interest payable.

Calculation of Interest on Savings

This section will provide instructions and examples for calculating interest on passbook savings and term deposits.

Interest Periods

The interest period is the span of time at the end of which savings in a client's account earn interest. Interest periods may vary; they may be daily, weekly, bi-weekly, monthly, semi-monthly, quarterly, semi-annual, or annual. Interest periods may differ for different types of savings products. In all cases, savings accounts must have established and published interest periods.

Interest Declaration Dates

In credit unions, the interest declaration date is the date that the board of directors declares an interest rate for the preceding period. For credit unions with longer interest periods (such as quarterly, semi-annual, or annual) the interest rate must be determined:

1. During the last month of the interest period; or
2. If the interest rate is determined prior to the end of the interest period, the rate is not declared but rather anticipated (projected), contingent upon income and earnings after required transfers to statutory reserves, during the first month following the close of the interest period.

The board of directors determines that there are sufficient earnings available after provisioning for loan losses and transfers to statutory reserves and ratifies the interest rate (most likely the anticipated rates). The day the interest rate is ratified is the interest declaration date.

Calculating Interest on Passbook Savings

There are two methods to calculate the interest on passbook savings:

1. The daily balance method; and
2. The average daily balance method.

Examples of each method are provided using account activity for one month, based on the *end-of-day balance* in the account. The interest calculation must be based on a point in time for determining the balance in the account, such as *beginning-of-day balance, end-of-day balance,* or *close-of-business-day balance*. Any one of the three may be used, but must be applied consistently.

EXAMPLE: Using the daily balance, based on end-of-day balance

The daily balance method is the application of a daily interest rate to the full amount of principal in the account each day. For the days the account is overdrawn, a zero balance is used to calculate the interest for those days.

The client makes numerous transactions throughout the month:

Transaction	Date	Amount	Client's Balance
Balance	12/31/2001		$1,000
Deposit	01/01/2002	$200	$1,200
Withdrawal	01/02/2002	$100	$1,100
Withdrawal	01/10/2002	$400	$700
Deposit	01/15/2002	$200	$900
Withdrawal	01/16/2002	$1,000	-$100
Deposit	01/18/2002	$300	$200
Deposit	01/21/2002	$700	$900
Withdrawal	01/31/2002	$100	$800

We assume an interest rate of 5.0%, a daily rate based on 1/365, a monthly compounding period, and a monthly crediting period. The daily rate would be 0.00013698630 (0.05 x (1/365)).

The interest due to the client above, based on the transactions above for the month of January is:

The formula is: **Interest = Balance x Daily Rate x Number of Days**

Dates	Number of Days	Calculations	Interest Amount
01/01/02	1	$1,200 x 0.00013698630	$0.164383562
01/02/02 to 01/09/02	8	$1,100 x 0.00013698630	$1.205479452
01/10/02 to 01/14/02	5	$700 x 0.00013698630	$0.479452055
01/15/02	1	$900 x 0.00013698630	$0.123287671
01/16/02 to 01/17/02	2	$0 x 0.00013698630	$0.000000000
01/18/02 to 01/20/02	3	$200 x 0.00013698630	$0.082191781
01/21/02 to 1/30/02	10	$900 x 0.00013698630	$1.232876712
01/31/00	1	$800 x 0.00013698630	$0.109589041
TOTAL	**31**		**$3.397260274**

Using the daily balance method, interest of $3.40 would be credited to the client's account for the month of January.

If the compounding period had been daily, there would have been 31 (the number of days in the compounding period) separate interest calculations performed. The first day's accrued, but uncredited, interest of $0.164383562 would have been included in the second day's balance to determine the second day's interest, and every day's interest thereafter.

EXAMPLE: Using the average daily balance, based on end-of-day balance

The average daily balance method is the application of a periodic interest rate to the average daily balance in the account for the period. The average daily balance is determined by adding the full amount of principal in the account for each day of the period and dividing that figure by the number of days in the interest period.

We assume of interest rate of 5.0%, a daily rate based on 1/365, a monthly compounding period, and a monthly crediting period. The periodic interest rate would be 0.00424657534 (0.5 x (1/365) x 31). Interest would be calculated as follows:

The formula is: **Interest = Balance x Number of Days**

DATES	BALANCE	NUMBER OF DAYS	CLIENT'S ACCUMULATED BALANCE
01/01/02	$1,200	1	$1,200
01/02/02 to 01/09/02	$1,100	8	$8,800
01/10/02 to 01/14/02	$700	5	$3,500
01/15/02	$900	1	$900
01/16/02 to 01/17/02	0	2	$0
01/18/02 to 01/20/02	$200	3	$600
01/21/02 to 1/30/02	$900	10	$9,000
01/31/02	$800	1	$800
TOTAL		**31**	**$24,800**

The accumulated *end-of-day* balance of $24,800 is divided by 31 (the total number of days in the interest period) to find the average daily balance of $800. The average daily balance should be rounded to five or more decimals, in this case $800.00000. In the case of overdrawn accounts, zero is used as the balance, since negative balances cannot be used in determining the average daily balance. The periodic interest rate multiplied by the average daily balance results in an interest amount of 0.004246575.

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.50 times 1/365	Result: 0.000136986
Step 3	0.000136986 times 31	Result: 0.004246575
Step 4	0.004246575 times $800	Result: 3.397260274
Step 5	Rounded	Result: $3.40

Using the average daily balance method, interest of $3.40 would be credited to the client's account for the month of January. In these examples, the two different methods yielded the same amount of interest due to the client.

Term Deposits

For the purposes of this exercise, term deposits include certificates of deposit, club accounts, and programmed accounts, which have some or all of the following characteristics:

1. Minimum amount to open the account;
2. Interest rates are subject to existing market conditions;
3. No withdrawal of funds during the term of the deposit, often requires a notice of withdrawal and penalties are imposed for early withdrawal;
4. In the case of club and programmed accounts, regular additions to the account are required; and
5. Terms are all in accordance with a written contract between the client and the institution.

The contract should contain the elements the institution considers necessary to protect itself and to make proper disclosures to the client. The contract should stipulate the frequency and the minimum amount of required payments to be deposited into the account. It also sets the interest rates and outlines any benefits of the account. The contract should answer the following questions:

1. What is the term or qualifying period? That is, how long must the client make regular payments to the account? For example, if the institution requires additions to the account for two years, two years is considered the qualifying period. It should be noted that a withdrawal of funds below the minimum amount requirement established may result in the imposition of a penalty.

2. Will the institution allow periodic payments in excess of the required amount to earn the premium interest rate and any other benefits of the account? If so, will the institution limit such excess amounts? Will additions to the account, after notice is provided, be permitted? Generally, additions to the account earn the premium interest rate if they are made pursuant to the contract.
3. What penalty, if any, will be imposed if the client fails to make the required periodic deposits? How many missed payments will constitute default?
4. Will notice of withdrawal require that a specific dollar amount be given? Will only a minimum amount have to be given or will it be a range of probable withdrawal amounts?
5. What is the minimum notice period and when must notice be provided?

The contract for term deposits should clearly set out all terms and conditions that affect the relationship between the savings institution and the client. A lack of specificity in the contract or incomplete coverage of the terms and conditions could result in problems for all parties.

Notice Upon Maturity

The institution should alert the client at least ten days prior to the maturity date of the account that the agreement is reaching maturity, and that if the client does not advise the savings institution on what to do with the proceeds, the proceeds will roll over into a new account with the current terms and conditions. Where certificates allow clients to add funds to their accounts, the additional funds do not extend the maturity of the certificate. Additions to the account are, however, usually subject to the same premature withdrawal penalties as the contracted amounts.

Interest Reductions and Penalties

Penalties are imposed for failure to comply with the terms or conditions of the contract. Generally, the penalties are on the interest earned on the account, subject to the institution's policies. A premature withdrawal of principal which reduces the balance below the required balance may cause the account to be cancelled, or liquidated into a passbook account. If the required minimum continues to be met, an interest rate penalty may be imposed only on the amount withdrawn.

A savings institution pays a higher interest rate on term deposits so that it can plan to use those funds for a determined period. The penalty should be sufficient to discourage clients from withdrawing funds in term deposits before the maturity date. Otherwise, the institution ends up paying a higher cost for the funds without being able to use them over longer periods.

Two Formulas for Calculating Compounding Interest on Term Deposits

Two simple formulas can be used to calculate compounding interest on term deposits (the two formulas should actually provide the same result if the institution has an automated system). In both cases, interest is paid monthly (or according to the set period), and interest the following month is paid on the new balance of the principal—including the interest earned for the previous month, and so on. The compounding continues until the maturity of the term deposit. The two formulas follow:

1. To calculate interest on term deposits compounding the interest:

$$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / \text{Compounding Period})^{(\text{Compounding Periods in Term})} - 1]$$

2. To calculate interest for term deposits when interest is paid at maturity:

$$\text{Interest} = \text{Principal} \times \text{Daily Interest Rate} \times \text{Days in Term}$$

Variables Used to Calculate Compounding Interest on Term Deposits

The formula is: $\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / \text{Compounding Period})^{(\text{Compounding Periods in Term})} - 1]$

Nominal rate is determined by dividing the interest rate by 100, or the interest rate expressed as a decimal.

Compounding rate stands for compounding period. Use the following based on the compounding period:

- Daily – 360, 365, or 366 in a leap year if interest is earned on February 29 for daily interest payments

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 365)^{(365)} - 1]$$

- Weekly – 52 for weekly interest payments

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 52)^{(52)} - 1]$$

- Bi-weekly – 26 if interest is paid every two weeks

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 26)^{(26)} - 1]$$

- Semi-Monthly – 24 if interest is paid twice a month

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 24)^{(24)} - 1]$$

- Monthly – 12 if interest is paid every month

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 12)^{(12)} - 1]$$

- Quarterly – 4 if interest is paid every 3 months

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 4)^{(4)} - 1]$$

- Semi-annually – 2 if interest is paid twice a year

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 2)^{(2)} - 1]$$

- Annually – 1 for annual payments

  $$\text{Interest} = \text{Principal} \times [(1 + \text{Nominal Rate} / 1)^{(1)} - 1]$$

Compounding periods in term refers to the number of compounding periods in the term. If interest is paid daily, the term is expressed in the number of days. If interest is compounded other than daily, the term is expressed in the appropriate number (same as above, weekly = 52, bi-weekly = 26, etc.)

Principal is the amount of funds deposited by the saver.

Calculating Interest on Term Deposits When Interest is Paid at Maturity

The daily balance method is the application of a daily interest rate to the full amount of principal in the account each day.

EXAMPLE: Calculation of interest on a term deposit using the daily balance method, based on end-of-day balance

We assume an interest rate of 5.0%, a daily rate based on 1/365, a monthly compounding period, and a monthly crediting period. The daily rate would be 0.000013698630 (0.05 x (1/365)). The client has $1,000 in the account. The client makes one deposit and does not withdraw any funds during the six-month term of the contract (such as in a certificate of deposit). Interest would be calculated as follows:

The formula is: **Interest = Principal x Daily Interest Rate x Days in Term**

MONTH OF MARCH		
Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 31 days	Result: 0.00424658
Step 4	0.00424658 multiplied by $1,000	Result: $4.246575342
Step 5	Round to $4.2465753	Result: $4.2466
Step 6	$4.2466 plus $1,000	Result: $1,004.2466
MONTH OF APRIL		
Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 30 days	Result: 0.004109589
Step 4	0.004109589 multiplied by $1,004.12465	Result: $4.127040740
Step 5	Round $4.127040740	Result: $4.12704
Step 6	$4.12704 plus $1,004.24658	Result: $1,008.37362
MONTH OF MAY		
Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 31 days	Result: 0.004246575
Step 4	0.004246575 multiplied by $1,008.37362	Result: $4.282134551
Step 5	Round $4.282134551	Result: $4.28213
Step 6	$4.28213 plus $1,008.37362	Result: $1,012.65575

MONTH OF JUNE

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 30 days	Result: 0.004109589
Step 4	0.004109589 multiplied by $1,012.65575	Result: $4.161598973
Step 5	Round $4.161598973	Result: $4.16160
Step 6	$4.16160 plus $1,012.65575	Result: $1,016.81735

MONTH OF JULY

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 31 days	Result: 0.004246575
Step 4	0.004246575 multiplied by $1,016.81735	Result: $4.317991486
Step 5	Round $4.317991486	Result: $4.31799
Step 6	$4.31799 plus $1,016.81735	Result: $1,021.13534

MONTH OF AUGUST

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 31 days	Result: 0.004246575
Step 4	0.004246575 multiplied by $1,021.13534	Result: $4.336328156
Step 5	Round $4.336328156	Result: $4.33633
Step 6	$4.33633 plus $1,021.13534	Result: $1,025.47167

A total of **$25.47** in interest would be credited to the client's savings account.

Calculation of Simple Interest on Term Deposits

Two formulas can be used to calculate the interest on a term deposit where interest does not compound. The difference between the two formulas is that one considers the actual number of days in the term of the deposit and the other counts the months in the term of the deposit. There is a slight difference in the interest paid. The two formulas follow:

The formula is:
Interest = Principal x Monthly Interest Rate x Months in Term

Principal is the amount of funds deposited upon opening the account.

Monthly interest rate is the nominal rate divided by 100 (or the interest rate expressed as a decimal) and then divided by 12 (number of months in a year).

Months in term refers to the number of months in the period.

EXAMPLE: Client deposits $1,000 for six months with annual interest rate of 5.0%

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 divided by 12 months	Result: 0.004166667
Step 3	0.004166667 multiplied by 6 months	Result: 0.025
Step 4	0.025 multiplied by $1,000	Result: 25.00

The payout, including principal and interest, at the end of six months is **$1,025.00**

The formula is: **Interest = Principal x Daily Interest Rate x Days in Term**

Principal is the amount of funds deposited upon opening of the account.

Daily interest rate is the nominal rate divided by 100 (or the interest rate expressed as a decimal) multiplied by the daily rate of 1/360, 1/365 or 1/366 during leap year if the account will earn interest on February 29.

Days in term refers to the number of days in the period.

EXAMPLE: Client deposits $1,000 for six months with annual interest rate of 5.0%

Step 1	5.0 divided by 100	Result: 0.05
Step 2	0.05 multiplied by 1/365	Result: 0.000136986
Step 3	0.000136986 multiplied by 184	Result: 0.025205479
Step 4	0.25205479 multiplied by $1,000	Result: 25.20547945
Step 5	Rounded	Result: $25.21

The payout, including principal and interest, at the end of six months is **$1,025.21**

These two examples show the difference between the two ways that simple interest can be calculated on term deposits. One way takes the number of days, while the other assumes that each of the six months has the same number of days. The difference between the two formulas yields a difference of **$0.21** in interest.

This tool provided readers with the basic principles for calculating interest on passbook savings and term deposits. Readers can run through the different examples using diverse scenarios (or scenarios from their own institutions) to achieve a better understanding of the varying results yielded by the different interest calculation methods.