Effective Cost of Borrowing in Microfinance

Deutsche Bank

Concept Level Discussion

Table of Contents

Micro-lending, a process that has been transforming the lives of millions is increasingly taking center stage in international discussions on poverty alleviation and economic development. While innumerable microfinance institutions dot the developing and underdeveloped countries offering loans to the poor, investors in the sector are realizing that not all such organizations are truly working with a **double bottom line objective**(1). The rising debate on interest rates charged to the borrowers in this sector has motivated us to develop a tool that can be used to measure the true cost of loans to MFI borrowers and provide an indication of the dual bottom line commitment of MFIs (Micro-Finance institutions). This tool compares the traditional methodology used to determine the effective interest rate to a borrower (what we call the arithmetic method) to a methodology that utilizes the concept of time value of money (i.e. discounted cash flow) to determine the "true" cost to the borrower.

It is important to note the distinction between the **effective portfolio yield** earned by an MFI and the **effective cost of a loan to the borrower**. The **portfolio yield** represents the return on the portfolio and is affected by the frequency of payment and growth of the portfolio. The **cost of a loan to the borrower** is independent of portfolio growth or the repayment frequency of other clients. Portfolio yield can provide a reference point for the cost of loans to the borrowers of the MFI, but because of the frequency of payment and portfolio growth can sometimes understate the true cost to the borrowers.

While we consider that effective cost of loan to a borrower is a good indicator of lending practices of an MFI, we also emphasize that it may not be the only or the best measure of dual-bottom line objective. We hope that others in the industry evaluate the metrics we are using and look forward to discussing other metrics as they develop.

Effective Cost of Loan to a Borrower

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Microfinance Institutions, like banks, structure loans with various features that significantly impact the true cost of a loan to its borrowers. While it is intuitive that the cost of a loan structured with a bullet maturity, involving no savings or origination fee and a regular interest payment schedule is equal to the interest rate charged, the cost can deviate significantly from the interest rate charged if these factors change.

Mathematically(2), at this stage, we may represent C_{eff}(the effective cost of loan to a borrower) as follows:

$$C_{eff} = f(\text{interest rate, maturity, amortization, origination fee, savings, interest earned on savings})$$

Following is a brief description of the parameters which determine the effective cost of loan to a borrower:

Interest Rates and Amortization

The combinations of different amortization and interest rate schedules can cause significant variations in the effective cost of loan to a borrower: a high frequency amortization schedule combined with interest rate charged on original loan balance (and not the outstanding loan balance) can cause effective cost of borrowing to double.

Origination Fee

The origination fee essentially causes a reduction in the upfront loan amount offered to a borrower (a reduction of the present value of the loan at origination). While borrowers need to pay interest on the entire loan amount, their true cash inflow is reduced by the origination fee, hence aggravating the effective cost of borrowing.

Savings and interest earned on savings

Many loans are structured with compulsory savings requirements, reducing the amount of cash received at origination. Given that the interest rate earned on savings is generally lower than the rate charged on the loan, this creates an additional drag on the effective cost of the loan. This drag is magnified if the MFI has in addition to an upfront compulsory savings requirement, periodic increases in the compulsory savings, as the amount of cash to the borrower is decreased.

(1) Double Bottom Line objective has been closely linked to socially conscious investing; the term generally refers to the dual goal of maximizing profits and maximizing social impact.
(2) For a detailed discussion on this calculation, please refer to page (2) of this document.

The Math behind Effective Cost of Loan to a borrower

Description of Terms

k : Current period

n : Total number of periods to maturity

P : Loan Principal offered to the borrower

O_f: Origination Fee charged to the borrower

S_0 : Mandatory upfront savings commitment

i_k : Interest rate charged for the period k

a_k : Loan principal amount amortized in period k

S_k : Mandatory savings commitment in period k

i_s : Interest paid by MFI to the borrower in period k

e_{cf} : End period cash inflow for the borrower (typically total savings contributed)

C_{eff}: True cost of loan to borrower computed using Discount Rate Method

C_{am}: Cost of loan to borrower calculated using Hybrid Arithmetic method

d: Number of days in the period

P_{avg}: Average outstanding loan principal – Average outstanding savings + (e_{cf}/2)

E_{xp}: O_f - e_{cf} + Sum of total interest paid on loan + Sum of total savings – Sum of total interest earned on savings

Discount Rate Method

$$P - O_f - S_0 = \sum_{k=1}^{n} \{(- i_k - a_k - S_k + i_{s,k} + e_{cf,k})/(1+C_{eff})^k\} \text{..........................(1)}$$

Mathematically, we may say that C_{eff} is the discount rate which equates all effective future cash flows made or received by the borrower to the present value of upfront cash received. In essence, the model has all of the other inputs and solves for the discount rate or effective interest rate.

Hybrid Arithmetic Method

$$C_{amh} = (1+ E_{xp}/P_{avg})\text{^}(365/(n^* d))-1 \text{ ....(2)}$$

Mathematically, we may say that C_{amh} is the average cost of borrowing funds paid by a borrower through the life of the loan assuming continuous re-borrowing (inverse of reinvestments) by the client.

Arithmetic Method

$$C_{am} = (E_{xp} /P_{avg})^*(365/(n^* d)) \text{ ....(2)}$$

Mathematically, we may say that C_{am} is the average cost of borrowing funds paid by a borrower through the life of the loan without taking into account the time value of money.

Subtlety

The effective cost of loan to the borrower computed in the above manner will be different (at times higher and at other times, lower) from the cost calculated by arithmetic averaging of outstanding loan principal amounts. This is due to the following reasons:

(1) *The arithmetic methods average the outstanding loan principal amount while the calculation of effective cost of borrowing (C_{eff}) involves weighting the periodic principal repayments by a discount factor which is the equivalent of $(1+C_{eff})^k$ described in equation (1) above.*

(2) *Additionally, the hybrid arithmetic method described above, assumes that interest paid is reinvested again at the same interest rate. While that may be true and accurate from the perspective of an MFI or investors interested in computing the return on loans/investments, it is not equally applicable to borrowers who may only be interested in the effective cost of the loan to them.*

Numerical Case Studies

Assumptions

	Case 1	Case 2	Case 3
Total Periods	31	31	31
Loan Amount	10,000	10,000	10,000
Amortization Schedule	Bullet	Linear	Linear
Origination Fee	0	500	500
Annual Loan Int. Rate	36.00%	36.00%	36.00%
Interest Calc. Method	Flat	Flat	Flat
Saving Schedule	N/A	40 per period	40 per period
Initial Savings Amount	0	1,000	1,000
Interest on Saving	N/A	6.00%	6.00%
Frequency	Weekly	Weekly	Weekly
End Period Cash Flow	N/A	2,240	2,240 (not returned)
Savings Repaid to client	N/A	Yes	No

Cash Flows

Periods	Loan Balance	Savings Balance	Interest	Loan Balance	Savings Balance	Interest	Loan Balance	Savings Balance	Interest
0	10,000	0	0	10,000	1,000	0	10,000	1,000	0
1	10,000	0	69	9,677	1,040	69	9,677	1,040	69
2	10,000	0	69	9,355	1,081	69	9,355	1,081	67
3	10,000	0	69	9,032	1,122	69	9,032	1,122	65
4	10,000	0	69	8,710	1,164	69	8,710	1,164	63
5	10,000	0	69	8,387	1,205	69	8,387	1,205	61
6	10,000	0	69	8,065	1,246	69	8,065	1,246	59
7	10,000	0	69	7,742	1,288	69	7,742	1,288	57
8	10,000	0	69	7,419	1,329	69	7,419	1,329	55
9	10,000	0	69	7,097	1,370	69	7,097	1,370	53
10	10,000	0	69	6,774	1,412	69	6,774	1,412	50
11	10,000	0	69	6,452	1,454	69	6,452	1,454	48
12	10,000	0	69	6,129	1,495	69	6,129	1,495	46
13	10,000	0	69	5,806	1,537	69	5,806	1,537	44
14	10,000	0	69	5,484	1,579	69	5,484	1,579	42
15	10,000	0	69	5,161	1,620	69	5,161	1,620	40
16	10,000	0	69	4,839	1,662	69	4,839	1,662	37
17	10,000	0	69	4,516	1,704	69	4,516	1,704	35
18	10,000	0	69	4,194	1,746	69	4,194	1,746	33
19	10,000	0	69	3,871	1,788	69	3,871	1,788	31
20	10,000	0	69	3,548	1,830	69	3,548	1,830	28
21	10,000	0	69	3,226	1,872	69	3,226	1,872	26
22	10,000	0	69	2,903	1,914	69	2,903	1,914	24
23	10,000	0	69	2,581	1,956	69	2,581	1,956	22
24	10,000	0	69	2,258	1,998	69	2,258	1,998	19
25	10,000	0	69	1,935	2,040	69	1,935	2,040	17
26	10,000	0	69	1,613	2,083	69	1,613	2,083	15
27	10,000	0	69	1,290	2,125	69	1,290	2,125	12
28	10,000	0	69	968	2,167	69	968	2,167	10
29	10,000	0	69	645	2,210	69	645	2,210	7
30	10,000	0	69	323	2,252	69	323	2,252	5
31	0	0	69	0	2,295	69	0	2,295	2

	Case 1	Case 2	Case 3
Discount Rate Method	36.00%	111.88%	160.95%
Hybrid Arithmetic Method	38.57%	110.01%	151.40%
Arithmetic Method	36.00%	93.26%	122.77%

Explanation

In Case 1, the discounted cost and arithmetic cost of borrowing are slightly lower than the hybrid arithmetic cost and equal the interest rate charged on the loan. As may be intuitively guessed, absence of any additional costs/benefits like savings, origination fee etc. makes 'Case 1' a straightforward example of valuation of future cash flows by applying a certain discount rate. As we are computing the cost to borrowers, the reinvestment assumption is invalid and the discount rate equals the interest rate charged to borrowers.

On the other hand, the hybrid arithmetic method yields a slightly higher cost of borrowing as it assumes interest paid by borrowers is reinvested at the same interest rate by the MFI. While this is an accurate assumption from the perspective of the MFI[(1)], it doesn't reflect the true cost to the borrower who is no longer responsible for reinvesting the interest payments at the same rate. This is an inherent limitation of the 'Internal Rate of Return' methodology which is implicit in the 'Hybrid Arithmetic Rate' method.

The effective cost of borrowing (discount rate method) is very close to the hybrid arithmetic cost in Case 2 and is relatively higher in Case 3. These two cases need to be viewed together in order to comprehend the manner in which the two cost of borrowing methodologies differ from each other. In Case 2, it is assumed that all savings are repaid to the borrower at the time of loan's maturity while in Case 3, the savings are assumed to be retained by the MFI. The effective rate calculation method discounts the principal repayments in every period and savings returned at maturity by the implicit discount rate while hybrid arithmetic method simply assumes an average of these values across the life of the loan. This causes the hybrid arithmetic method to overestimate the time value of this payment (it will of course be also impacted by the frequency of amortization and interest rate charged) and hence, yields a lower cost of borrowing. This difference will increase or decrease with changes in following parameters:

(1) Amount of principal amortized in every period
(2) Frequency of amortization – weekly, bi-monthly, monthly, quarterly
(3) Interest rate charged to the borrower

It should be noted that the significantly lower rates shown by the arithmetic method are clearly due to absence of time value of money in the calculation.

Conclusion

While the microfinance sector is gradually evolving into a unique asset class and has historically displayed resilience to economic crises. In order for the asset class to move into its next stage of development, fair, transparent and reasonable loan pricing practices need to be followed. We have analyzed the cost of borrowing calculation methodologies prevailing in the market today, and consider that the effective cost (discount rate method), calculated as the discount rate equating all future cash flows made or received by the borrower to the present value of upfront cash received, is an accurate reflection of the true cost to the borrower and is truly independent of other noise factors such as reinvestment assumptions which are more valid from an investor's perspective.

We are optimistic about the prospects this new asset class has to offer and innovations that are ahead of us and consider that our effective interest rate calculation tool might be a small step forward in our pursuit of ethical lending practices in the sector.

(1) Please refer to the detailed discussion on page (2) under the 'Subtlety' section