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MEASURING MICROCREDIT DELINQUENCY:
Ratios Can Be Harmful to Your Health

CGAP

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Let's start with the good news. As the microfinance movement matures, both microcredit practitioners and the donors who fund them are focusing more consistently on the importance of portfolio quality: how well are microfinance institutions (MFIs) recovering the money they lend? Loan recovery is, after all, the most basic ingredient of long-term sustainability.

Ten years ago a description of an MFI might say little about loan recovery, or at least fail to quantify it. Today, most write-ups of MFIs include a delinquency or repayment rate. For instance, "MicroFin has maintained an impressive 98 percent loan recovery rate." But this simple example also illustrates the bad news—too often, the reader gets a number but no information about the measuring rod being used. MFIs use dozens of ratios to measure delinquency. Depending on which of them is being used, a "98 percent recovery rate" could describe a safe portfolio or one on the brink of meltdown.

Any delinquency or recovery percentage is a ratio—the result of dividing some numerator on the top of the fraction by some denominator on the bottom. Unless we know exactly what goes into the numerator and the denominator, delinquency ratios are more likely to obscure the real situation than to illuminate it. This paper aims to convince the reader of this point, and to discuss the uses and misuses of some common portfolio quality measures.

Why get so exercised about transparent delinquency measurement? True, MFIs often give donors an overly optimistic view of their portfolio quality—not necessarily intending to. But the jaded writer of this paper is neither surprised nor particularly horrified by the prospect of an occasional donor being misled. The more serious danger is that a misapplied portfolio quality measure often conceals a repayment crisis from MFI managers themselves, sometimes to the point where it has become too late to fix the problem.

Delinquency tends to be more volatile in MFIs than in commercial banks. Most microloans are not secured by tangible assets that can be seized or sold easily in case of default. The clients' main motivation to repay is their expectation that the MFI will continue providing them with valued services in the future if they pay promptly today. This motivation may be reinforced by peer pressure, especially in group lending programs. In these circumstances, any serious outbreak of loan delinquency can quickly spin out of control. As clients watch their peers default, they lose confidence in the MFI's ability to serve them in the future, and the peer pressure to repay can dissipate quickly. Many an MFI has died of a repayment cancer that could have been cured if it had been detected and dealt with earlier. Meaningful delinquency monitoring is a crucial diagnostic tool.

Why are there so many different delinquency measures in use? Managing loan collection poses quite a few different questions, and no indicator answers them all. The most sophisticated MFIs all track more than one measure. And selection of a particular ratio is often driven by the availability of information: the MFI has to settle for a less-than-ideal version of an indicator because its systems cannot produce the information needed for the ideal indicator it would have preferred.

So delinquency measurement can get complicated. An MFI needs to choose among the available measures, figure out how to manage irregular transactions like prepayments or loan renegotiations, and determine whether its information system can be made to produce the necessary numbers. Every time one thinks one has finally sorted out all the issues, an annoying new wrinkle is sure to float into view. In light of such factors, this paper can't provide definitive guidance about how to measure delinquency in specific situations. Its aim is less ambitious—to sensitize the reader to some of the major dynamics and pitfalls involved. To keep the paper short, the author has had to sneak past some complications: he cheerfully assumes that the reader who is clever enough to catch him oversimplifying things will probably be clever enough to handle delinquency measures effectively without his help.

Most of the discussion will be devoted to three broad types of delinquency indicators:

- *Collection* rates measure amounts actually paid against amounts that have fallen due.
- *Arrears* rates measure overdue amounts against total loan amounts.
- *Portfolio at risk* rates measure the outstanding balance of loans that are not being paid on time against the outstanding balance of total loans.

But the reader must be warned that there is no internationally consistent terminology for portfolio quality measures—for instance, what this paper calls a "collection rate" may be called a "recovery rate," a "repayment rate," or "loan recuperation" in other settings. No matter what name is used, the important point is that we can't interpret what a measure is telling us unless we understand precisely the numerator and the denominator of the fraction.

A. How to Tell a Good Ratio from a Bad One

Before we line delinquency ratios up against the wall to evaluate them all (and perhaps shoot a few), decency requires that we first advise them what we're going to expect of them. We'll look at some common ratios in light of their performance on five tests:

- As a matter of day-to-day portfolio management, an MFI needs a monitoring system that highlights repayment problems clearly and quickly, so that loan officers and their supervisors can focus on delinquency before it gets out of hand. Thus we have a *red flag* test: does the delinquency ratio support timely response to day-to-day repayment issues?
- When delinquency has reached dangerous levels, does the ratio reveal the seriousness of the problem, or does it tend to camouflage it? This is our *fire bell* test. (Both this and the previous test focus on problems: red flags are for day-to-day problems, while fire bells signal emergencies of longer-term consequence.)
- A loan is delinquent when a payment is late. But the fact that a payment is late right now doesn't mean that it will never be paid in the future: delinquency is not the same thing as loan loss. We measure delinquency because it indicates an increased risk of loss. In addition to warning us of operational problems, a delinquency measure may help us predict how much of our portfolio will eventually be lost because it never gets repaid. This is our *bottom line* test: does the measure we're using give us a reasonable basis for estimating likely loan losses, preferably as a percentage of our outstanding portfolio? Without realistic provisions for likely loan losses, we will overestimate our net profit and the real worth of our portfolio.[1] Likewise, we need to know our loan loss rate in order to factor this cost into the interest rate we charge.[2]

[1] As used in this paper, "provision" means an extra expense shown as a *flow* variable in the income statement to reflect probable losses due to non-repayment of loans. Provisions build up the value of a loan loss "reserve," a *stock* value on the balance sheet which reflects a lessened worth of the active loan portfolio due to anticipated loan losses. When the probability of collecting an individual loan becomes very low, it is "written off": that is, it disappears from the lender's books, as the loan portfolio and the loan loss reserve are both reduced by the amount of the unrecoverable loan. After the write-off, it may be necessary to provision further amounts in order to bring loan loss reserves up to a high enough level in relation to the active portfolio.

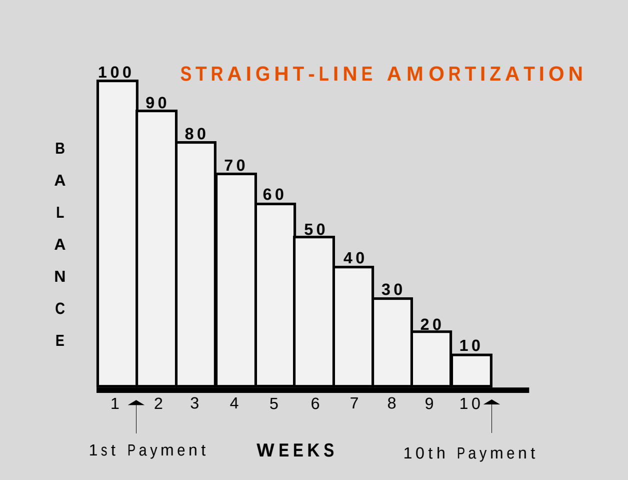
[2] See CGAP, "Microcredit Interest Rates," Occasional Paper 1 (revised), 1996.

- Can the delinquency measure be made to look better through inappropriate rescheduling or refinancing of loans, or manipulation of accounting policies? This is our *smoke and mirrors* test.
- Finally, does the delinquency measure help us predict the flow of cash from our portfolio, so that we can balance sources and uses of funds to avoid running out of cash? Having exhausted our supply of awkward metaphors, we'll just call this our *cash-flow* test.

The reader who can't stand suspense, or who wants a bird's-eye view of this paper before plunging into a forest of details, may wish to steal a preliminary glance at section G, which contains a summary of conclusions and a report card grading several common delinquency measures.

B. Measuring the Universe of Total Loans

We need to touch on one more preliminary matter before we start interrogating delinquency ratios. Some measure of the MFI's total loan activity shows up in the denominator of many delinquency ratios (and all loan loss ratios). Great confusion results if we aren't clear about the differences among various measures of loan activity.



Imagine a loan whose principal of 100 is payable in weekly installments of 10 each. The amount disbursed is 100: at the time of disbursement, this 100 is also the outstanding (unpaid) balance of the loan. The outstanding balance on the MFI's books—that is, the amount the client still owes—declines as the client makes weekly payments. Totaling the weekly balances (100 + 90 + … + 10 = 550) and dividing by 10 weeks gives us an average outstanding balance of 55 over the ten-week life of this loan.

Now imagine that we have an active portfolio of 1,000 loans just like this one, evenly distributed as to their age—that is, 10 percent of them are in their first week, 10 percent are in their second week, and so on. The total disbursed amount of these loans is 100,000. But the portfolio shown on the MFI's books is not the *original* disbursed amount. Rather, book portfolio is only the *unpaid* amounts that clients still owe: 1,000 loans times 55 average outstanding balance = 55,000 portfolio outstanding.

If each payment contains the same amount of principal (straight-line amortization), the average outstanding balance on a loan can be calculated with a simple formula:[3]

$$\frac{\text{original principal + amount of principal in one payment}}{2}$$

Average outstanding balance is usually close to 50 percent of original principal amount, except where loans are repaid in a small number of payments.

For 36 payments, the ratio is	51.4 percent	(1 + 1/36) ÷ 2
24	52.1	
12	54.2	
6	58.3	
3	66.7	

Now we will complicate our case by assuming that the MFI renews its 10-week loans five times a year, without changing their amounts or terms. In this case the *outstanding portfolio* will continue to be 55,000 at any time during the year. The *original principal of loans outstanding* at any given time will be 100,000. However, the *annual amount disbursed* jumps to 500,000. Clearly it will make a big difference which of these numbers we use in the denominator of any delinquency ratio.

[3] This formula applies precisely only for straight-line amortization where each payment contains the same amount of principal. A different "declining balance" amortization scheme is often found in housing finance, and is used by financial calculators: the total payment is always the same, but the division between principal and interest changes over the life of the loan. For our purposes here, the difference in average outstanding balance between straight-line amortization and declining balance amortization is not substantial, unless the number of payments or the interest rate per period is unusually high.

C. Collection Rates

$$\frac{\text{amounts collected}}{\text{amounts fallen due}}$$

Many an MFI claims to recover 98 or 99 percent of the funds it lends. This claim implies an indicator whose numerator is actual cash collections of principal and whose denominator is the principal amount that was due to be paid. We'll call this kind of ratio a collection rate, but it is also called a repayment rate or a recovery rate.

A collection rate has the advantage of using elementary information that even simple information systems can usually generate. As a result this kind of portfolio quality measure is used by more MFIs than any other.

A collection rate seems to be the complement of a delinquency rate: if we collected 98 percent of the payments that fell due during a period, then obviously the remaining 2 percent of the payments due were not collected. But this apparently simple relationship gives rise to a widespread and dangerous misinterpretation. There seems to be a nearly irresistible tendency to assume that a collection rate is the complement of a *loan loss rate*.[4] An MFI that maintains a consistent 95 percent collection rate may think it is losing only 5 percent of its portfolio each year to default. This kind of assumption is almost always wrong, sometimes fatally so.

Consider a hypothetical MFI with 1,000 clients who continually receive three-month loans of 130, repayable in 13 weekly installments of 10 each. The disbursement dates of these loans are distributed randomly throughout the year, so the outstanding balance of the portfolio remains constant. Suppose that every loan suffers a single missed installment that is never recovered.[5] An operating grant from a donor permits the MFI to replace these losses and keep its portfolio at a constant size. Out of 130,000 disbursed for a loan cycle, the MFI recovers 120,000 and loses 10,000. Thus its collection rate is 92.3 percent. This number may not provoke cheers, but neither does it have a disastrous ring to it. The fire bell seems silent.

What percentage of its portfolio does this MFI lose every year? (Hint: don't subtract 92.3 from 100 and guess 7.7 percent.)

First, we need to recognize that this MFI loses 10,000 on *every loan cycle*. It runs through four three-month cycles each year, so its annual loss is 40,000. Second, the loans that are active at any point in time have an original amount disbursed of 130,000, but we have to remember that this is not the same as the amount of portfolio outstanding. Using the formula given in section B, we calculate the average outstanding balance on a single loan as (130 + 10) / 2 = 70. The portfolio of 1,000 loans on the MFI's books at any point during the year is not 130,000 but 70,000. This latter number—the outstanding portfolio—is more relevant than the amount disbursed. The outstanding portfolio represents the actual quantity of funds committed to the lending operation; it is this amount, not the amount disbursed, that the MFI really owns and really has to finance. Having analyzed the situation more closely, we find that our hypothetical MFI, whose 92.3 percent collection rate didn't sound too terrifying, is in fact losing 57 percent (40,000 / 70,000) of its portfolio every year. Now the fire bell is clanging away.

If we applied the same analysis to an MFI with a 99 percent collection rate on two-month loans payable weekly, we would find that it loses about 11 percent of its portfolio to default each year. These simplified examples are imaginary, but hundreds of real MFIs are deceived by high-sounding collection rates into thinking that their portfolios are solid.

[4] A loan loss rate tells us what percentage of a lender's loan portfolio is irrecoverably lost during a period (usually a year). Conceptually at least, the direct calculation of an annual loan loss rate seems straightforward: the amount of loans written off as unrecoverable is added to any increase in the loan loss reserve on loans not yet written off, and divided by the average outstanding portfolio over the course of the year. In practice, many MFIs can't directly calculate a meaningful annual loss rate, because they haven't followed sound, consistent policies in writing off loans and in provisioning adequate loss reserves for loans that haven't been written off, or because of weaknesses in their information system. Such MFIs may be able to use the indirect method presented here, which allows an MFI to estimate its annual loss rate if it is tracking a collection rate.

[5] The reader who prefers a slightly more realistic example can reach the same conclusion by assuming that 90 percent of the clients pay perfectly, while the remaining 10 percent fail to make any payment on their loans.

Readers who like equations can find general formulas for converting a collection rate into an annual loan loss rate in an annex at the end of this paper. At this stage of the discussion we'll use a simplified formula that is accurate enough for most practical purposes:

$$\text{ALR} = \frac{1 - \text{CR}}{\text{T}} \times 2$$

where *ALR* is the annual loss rate, *CR* is the collection rate, and *T* is the loan term expressed in years. (The annex shows how to treat a portfolio with a variety of loan terms.)

In the example a few paragraphs earlier, the collection rate was 92.3 percent, and the average loan term was 0.25 years. Our simple formula yields an annual loss rate of 62 percent, acceptably close to the 57 percent we calculated directly in that example.

$$0.616 = \frac{1 - 0.923}{0.25} \times 2$$

This formula and its result make intuitive sense. If our collection rate is 92.3 percent, we lose 7.7 percent of the amount disbursed each loan cycle. Because the outstanding balance is roughly half of the amount originally disbursed, 7.7 percent of the disbursed amount is about 15 percent of outstanding balance. Our loan cycle is three months, so we lose this 15 percent four times a year, for a total annual loss rate around 60 percent of outstanding balance.

Using the same simplified formula, Table 1 shows how dangerous the widespread misinterpretation of collection rates is, especially for MFIs that use short loan cycles. The assumption that the loan loss rate is equal to 100 percent minus the collection rate holds only for two-year loans.

Now we can pause for a quick overview of how collection rates, taken as a group, stand up to our five tests. We've seen that collection rates, if not understood correctly, fail our fire bell test miserably. However, after a suitable algebraic massage a collection rate not only serves as an effective alarm, but also meets our bottom line test, because it lets us estimate an annual loan loss rate. (Alas, life is never simple. Our algebraic manipulation works only for collection rates whose numerators count all amounts paid, and whose denominators count—but do not double-count—all amounts falling due. Readers confused by this cryptic statement need not despair, because it will be illustrated when we discuss specific variants of the collection rate.)

Table 1: Converting a collection rate into an approximate annual loan loss rate

COLLECTION RATE:	PERCENT OF AVERAGE PORTFOLIO LOST ANNUALLY ON LOANS OF					
(percent)	**2 months**	**3 months**	**6 months**	**9 months**	**1 year**	**2 years**
99	12	8	4	3	2	1
98	24	16	8	5	4	2
97	36	24	12	8	6	3
95	60	40	20	13	10	5
90	120	80	40	27	20	10
80	240	160	80	53	40	20
70	360	240	120	80	60	30

Certain collection rates can be star performers on our cash-flow test. Most MFIs can keep track of how much clients are due to pay in future periods. Armed with a collection rate summarizing the percentage of payments falling due that have actually been collected in past periods, an MFI can approximate its future cash receipts from loans by simply multiplying the historical collection rate by the amount that will be falling due.

As we will see below, whether a particular collection rate does well on our red flag (day-to-day portfolio management) test depends on what is in the numerator of the rate. Performance on the smoke and mirrors test also varies among versions of the collection rate.

After that overview, we can refine our analysis by focusing on four distinct types of collection rates:

- The best day-to-day red flag performer is an *on-time collection rate* that tracks success in collecting payments when they first become due. (This measure needs to be supplemented by a *clean-up report* that tracks collection of late payments.)
- A common *Asian collection rate* divides all payments received during a period by all amounts due during that period, including past-due amounts from prior periods.
- A version that we will call the *current collection rate* divides cash received during a period by cash that first fell due during that same period.
- The *cumulative collection rate* is similar, except that it covers payments received and payments due over the entire life of the MFI.

The last two of these collection rates can be algebraically manipulated to estimate loan loss rates.

On-time collection rate. In the microfinance program of Chile's Banco del Estado, the principal tool for day-to-day portfolio management is an on-time collection rate. For each period, the denominator is amounts falling due *for the first time* during the period, and the numerator is amounts that have been paid *on time* (and in cash).

This measure provides a responsive red flag for loan officers and their supervisors: it gives instant and unambiguous feedback about the timeliness of client payments. Unlike other collection rates, the on-time collection rate excludes overdue payments from both the numerator and the denominator. Inclusion of overdue payments can introduce confusing "noise" into the short-term information circuit. Suppose client payments of 100,000 fell due this past week, and we collected that same amount during the week. If our numerator combines on-time payments with late payments of past-due amounts, we can't tell whether the 100,000 we collected reflects all of our clients paying on time, or whether 20,000 came from payment of old past-due installments and only 80,000 came from on-time payment of current maturities. The latter situation would demand an immediate operational response.

The manager tracks an on-time collection rate on a monthly, weekly, or even daily basis for branch offices and individual loan officers. When this rate shows a collection deficit, field staff follow up immediately. The main advantage of this indicator is its ability to focus field staff's attention in the short term on the most important practical job at hand—to go out and collect the payments that didn't come in on time yesterday.

For the sake of clear focus on what's happening in the short term, the on-time collection rate excludes past due amounts from the denominator and late payments from the numerator. Nonetheless, performance in collecting overdue amounts needs attention, so if an on-time collection rate is the primary day-to-day delinquency measure it should be supplemented with some kind of clean-up report. For instance, such a report might show that last month the MFI (or the branch or the loan officer) collected

75 percent of payments that were overdue	1-30 days,
40 percent	31-90 days,
15 percent	91-180 days, and
5 percent	past 180 days.

Close observation of the on-time collection rate together with a clean-up report can educate management about important seasonal patterns in clients' behavior.

Because it excludes late payments, the on-time collection rate cannot be algebraically manipulated to estimate a longer-term annualized loss rate: loss rates reflect, not payments that aren't made on time, but rather payments that aren't made at all. A loss rate might be estimated by combining on-time collection information with information on late payments from the clean-up report, but this will probably be cumbersome; if estimating a loss rate is the main objective, it may be easier to use the current collection rate described below.

Because cash flow consists not just of on-time payments but also of late payments and prepayments, the on-time collection rate alone is not a good measure for estimating future cash flow.

Table 2: The Asian collection rate vs. actual long-term collection

PERIOD	1	2	3	4	5	6	7	...	100	Total
(1) Current due	1,000	1,000	1,000	1,000	1,000	1,000	1,000	...	1,000	100,000
(2) Collected	0	1,000	1,000	1,000	1,000	1,000	1,000	...	1,000	99,000
(3) Current + past due	1,000	2,000	2,000	2,000	2,000	2,000	2,000	...	2,000	199,000
(4) Asian collection rate [(2)/(3)]	0%	50%	50%	50%	50%	50%	50%	...	50%	
(5) Cumulative average of (4)	0%	25%	33%	38%	40%	42%	43%	...	49%	
(6) Cumulative collected / Cumulative due [∑(2)/ ∑(1)]	0%	50%	67%	75%	80%	83%	86%	...	99%	

Asian collection rate. Some Asian lenders rely on a collection rate whose numerator is all cash collected during a period (including prepayments as well as late payments that first fell due in prior periods) and whose denominator is everything that was due during that period (including past-due amounts from prior periods). The wide use of this measure is odd, given how poorly it works.

The argument for including past due amounts from earlier periods in the denominator sounds straightforward: since we should be trying to collect these amounts each period, they ought to be included in the performance indicator for the period. But as noted above, we can get a better day-to-day red flag indicator by using an on-time collection rate together with a clean-up report. From an operational perspective, we want to be able to distinguish amounts that have just fallen due from past-due amounts. Lumping old arrears and current maturities together is especially problematic when the lender is not writing off bad loans aggressively. In such a case, ancient arrears that are never going to be collected can pile up in the denominator of the collection rate and be repeated indefinitely. This makes it impossible to see what is happening to the recent portfolio, which should normally be the main concern. If an institution has changed its lending or collection practices following a delinquency outbreak, the Asian collection rate doesn't present a sharp enough picture of whether the new practices are working.

The Asian collection rate falls apart on our bottom line test. Including past-due amounts in the denominator results in double-counting. A payment due shows up during the period when it first falls due, and in every subsequent period until it is collected or written off. But a payment collected only shows up once. Table 2 models an extreme illustration of this dynamic. A hypothetical loan portfolio runs for 100 successive periods, with regular payments of 1,000 falling due each period. During the first period nothing is recovered. In each subsequent period 1,000 is recovered. The collection rate would be zero percent for the first period. In the second period, receipts of 1,000 would be divided by demand of 2,000 (1,000 overdue from the first period and 1,000 coming due during the second period), producing a collection rate of 50 percent. The same 50 percent collection rate would prevail in all subsequent periods. But in fact, by the end of 100 periods the institution will have recovered 99 percent of the loan amounts it disbursed—even though its collection rate never rose above 50 percent.

Because overdue amounts are counted more than once in the denominator of the Asian collection rate, the sum of the denominators (line 3 of Table 2) will exceed the total due under the loan (line 1) whenever there is any net delinquency. Thus the average value of the collection rate over the life of the loan (line 5) will be lower than the actual long-term collection performance (line 6). The amount of this gap depends on the amount and length of delinquency, and appears impossible to estimate analytically. As noted, the gap will be especially problematic in an MFI that is not writing off old loans aggressively. Because of this gap, the Asian collection rate doesn't provide a meaningful bottom-line approximation of how much of the portfolio is likely to be lost, either intuitively or after algebraic manipulation. The same gap makes this indicator useless for cash flow projection. Nor does the indicator work well as a fire bell—it is too prone to false alarms.

Table 3: Smoothing current collection rate volatility

MONTH	1	2	3	4	5	6	7	8	9	10	11	12
1. Current am't due in period	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
2. Current payments collected	900	800	1,000	950	850	900	900	850	800	850	950	850
3. Late payments collected	0	0	0	50	0	200	0	0	50	0	150	50
4. Prepayments collected	50	0	100	0	0	0	0	0	150	0	0	0
5. Total payments collected	950	800	1,100	1,000	850	1,100	900	850	1,000	850	1,100	900
COLLECTION RATES (percent)												
6. **Current collection rate: monthly**	**95**	**80**	**110**	**100**	**85**	**110**	**90**	**85**	**100**	**85**	**110**	**90**
7. Current collection rate: quarterly			95			98.3			91.7			95
8. Current collection rate: by semester						96.7						93.3
9. Current collection rate: 6-month moving average*						96.7	95.8	96.7	95	92.5	96.7	93.3
10. Cumulative collection rate [$\Sigma(5) / \Sigma(1)$]	95	87.5	95	96.3	94	96.7	95.7	94.4	95	94	95.5	95

*Average of the six months ending with the current month

Finally, the Asian collection rate fails the smoke and mirrors test. It can create an incentive to "evergreen" loans. Suppose a certain past-due loan is really uncollectable. If the MFI reschedules or refinances it, its accumulated overdue amount will disappear from the next period's denominator, thus raising the ratio's value. Of course, this apparent improvement in the collection rate will be only temporary, and will have nothing to do with the real collection performance of the portfolio. A related dynamic is worth mentioning: a large accounting write-off will produce a major improvement in the Asian collection rate. When a substantial quantity of past-due amounts disappears from the denominator of the fraction, its value rises even though there has been no real change in the underlying collection performance. The evolution of an Asian collection rate over time will create a misleading impression unless write-offs are factored into the picture—something that is hard to do in any systematic mathematical way.

Current collection rate. The numerator of the current collection rate is all cash received in payment of loans during the period, whether this cash represents current payments, prepayments, or late payments of amounts overdue from previous periods. The denominator is all amounts that fall due for the *first time* during the period. Normally, the numerator and denominator include principal only, excluding interest. But a lender whose information system has trouble sorting payments into principal and interest can use a current collection rate based on total payment amounts without seriously distorting the results. (The same is true, incidentally, of the on-time collection rate.)

The current collection rate is not a stellar performer on our red flag test. Its numerator lumps together prepayments, payments of current maturities, and late payments. The failure to distinguish among these types of payments can obscure a manager's picture of what is happening to her portfolio in the short term. The inclusion of prepayments and late payments in the numerator can cause the current collection rate to fluctuate considerably from one period to the next even though there has been no significant change in the overall risk profile of the portfolio. To take the simplest case, a loan payment that is delayed for one period will lower the current collection rate for that period and then raise it for the next. Table 3 illustrates how prepayments and late payments can produce volatility, and suggests four approaches for smoothing it out.

Over the span of a year the hypothetical MFI in Table 3 is recovering 95 percent of the amounts due. Measured each month, the current collection rate jumps around a lot, from a low of 80 percent to a high of 110 percent. But this volatility probably reflects random or seasonal variation in the timing of prepayments and late payments, rather than significant changes in the underlying risk of the portfolio. Measuring on a quarterly basis smoothes much of the volatility. Measuring by semester or with a six-month moving average smoothes the current collection rate even more. So does the use of a cumulative collection rate, at least after the first few months. The only way to be sure of eliminating seasonal fluctuation is to measure the collection rate on an annual basis.

There is a tradeoff here. Using a broad measuring span, such as a year, eliminates seasonal or other short-term sources of volatility and leaves an indicator that better reflects the long-term underlying risk of the portfolio. But the longer the measuring span, the less responsive the current collection rate will be to real short-term changes in borrower behavior and the less useful it is as a red flag. The on-time collection rate discussed earlier is a more responsive indicator of day-to-day portfolio performance, and is thus a better guide for day-to-day operations, especially if it is supplemented by a clean-up report.

The main advantage of the current collection rate (and of the cumulative version of it discussed below) is its performance on the bottom line test: even a simple information system can use this measure to estimate the annual loan loss rate, applying the formulas given earlier in this section and in the annex. With this algebraic adjustment, the current collection rate provides an excellent fire bell. But as noted, the measure can be disastrously misleading without such an adjustment.

A current or a cumulative collection rate can be a powerful tool for cash-flow planning: an MFI can estimate actual cash receipts from loan payments during a future period by simply multiplying the total of payments falling due during the period by the historical collection rate.

Cumulative collection rate. Many institutions, such as the huge Unit Desa system of Bank Rakyat Indonesia, report a cumulative collection rate. The numerator reflects all principal payments received since the inception of the program. The denominator is all repayments of principal that have fallen due as of the date of measurement (or in other cases, all disbursements). Because it smoothes out the random or seasonal volatility caused by the timing of prepayments and late payments, the cumulative collection rate can provide a clear bottom line picture of long-term portfolio quality—but only if it is accompanied by information on the average loan term. Table 1, which converted collection rates into annual loan loss rates, showed that a cumulative collection rate of 98 percent would be excellent for an MFI making two-year loans (only about 2 percent of the portfolio is lost each year), but disastrous for an institution making two-month loans (nearly a quarter of portfolio is lost each year).

Not surprisingly, this cumulative historical measure doesn't work well as a red flag for early warning purposes. A simple example illustrates this problem:

	Amounts due	Amounts collected	Collection rate
Cumulative through June 30, 19xx	2,000,000	1,980,000	99.0% (cumulative collection rate)
July, 19xx	10,000	5,000	50.0% (current collection rate)
Cumulative through July 31, 19xx	2,010,000	1,985,000	98.8% (cumulative collection rate)

An MFI tracking only a cumulative measure might barely notice the drop from 99 percent to 98.8 percent, even though it reflects a serious current repayment problem. The cumulative collection rate is a meaningful long-term measure of bottom line portfolio performance, but for day-to-day analysis and management it needs to be accompanied by some other measure more sensitive to recent repayment performance.

Renegotiated loans. When a borrower runs into repayment problems, an MFI will often renegotiate the loan, either rescheduling it (that is, stretching out its original payment terms) or refinancing it (that is, replacing it—even though the client hasn't really repaid it—with a new loan to the same client). These practices complicate the process of using a collection rate to estimate an annual loan loss rate. Before exploring those complications and suggesting alternative solutions for dealing with them, the author needs to issue a warning: any reader looking for a perfect solution will be disappointed. The suggested approaches all have drawbacks. It is important to recognize that heavy use of rescheduling or refinancing can cloud the MFI's ability to judge its loan loss rate. This is one of many reasons why renegotiation of problem loans should be kept to a minimum—some MFIs simply prohibit the practice. And renegotiated loans should always be flagged and reported separately from the rest of the portfolio, as discussed in a later section.

To illustrate the complications and solutions, we will assume that a client has missed the first three monthly payments of a six-month loan. After the third missed payment, the loan is rescheduled by changing the terms of the original loan, or refinanced by replacing the original loan with a new one. Either way, the client is now expected to make six payments beginning in the fourth month. The client complies with this new obligation. If each month we make an entry recording the payment expected that month, our collection register will produce a strange result:

Month	Amount due	Amount collected
1	100	0
2	100	0
3 (renegotiation)	100	0
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100
9	100	100
Total	900	600

Even though the MFI has completely recovered its loan, its collection rate for the nine months seems to be only 67 percent (600 / 900). This anomaly stems from the double-counting of amounts due.

There would seem to be three ways to avoid this double-counting. Under the first approach, at the time of renegotiation we would retroactively eliminate the missed payments from the register of payments due (thus changing the collection rate for the first three months). The final treatment of the loan would then be as follows, showing a 100 percent collection rate for the nine months. The drawback of this method is that going back to change our record for the earlier period may be problematic.

Month	Amount due	Amount collected
1	0	0
2	0	0
3	0	0
(renegotiation)		
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100
9	100	100
Total	600	600

A second approach would be to treat the renegotiation as a payoff of the missed payments under the original loan. This treatment also produces a 100 percent collection rate, corresponding to the complete repayment of the amount lent to the client:

Month	Amount due	Amount collected
1	100	0
2	100	0
3	100	0
(renegotiation)		300[6]
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100
9	100	100
Total	900	900

Treating our renegotiated loan this way adds an extra 300 to both the numerator and the denominator of our collection rate, thereby inflating the value of the ratio for our overall portfolio. If we are renegotiating a substantial percentage of our loans, this distortion could be material.

A third approach is mentioned in a hushed voice and is not necessarily recommended, because the author has not seen it used in practice, and two expert reviewers of this paper recoiled in horror at its unorthodox nature. This approach would tie the denominator of the current collection rate to the terms of the *original* loan contract. At the time a loan is made, the information system would schedule all the loan's payments according to the periods when they're expected. As each period occurs, the collection rate register uses the payment amount scheduled for that period. When a loan is renegotiated, the denominator continues to use the payment amounts and times provided in the original agreement.

(If the renegotiated loan adds unpaid interest to the principal amount, or otherwise increases the principal payments due, then the amount of the increase is spread out over the future periods when it is due to be paid.)

Month	Amount due	Amount collected
1	100	0
2	100	0
3	100	0
(renegotiation)		
4	100	100
5	100	100
6	100	100
7	0	100
8	0	100
9	0	100
Total	600	600

Likewise, if an accounting decision is made to write off the loan, nothing changes in the current collection rate denominator. This technique passes our bottom line test, because it introduces no algebraic distortion into our estimation of a loan loss rate. It also scores well on the smoke and mirrors test: when a portfolio is measured this way, there is no incentive to engage in inappropriate write-off, rescheduling, or refinancing, because none of those actions affects the ratio. The substantial drawback is that this approach requires maintaining a parallel payments-due register that does not always correspond to the actual payments that are legally due and collectable. For instance, the register illustrated above shows no payments due in months seven, eight, and nine, even though renegotiated payments do in fact fall due in each of them. Thus, this presentation of renegotiated loans could not be used in a report intended to guide day-to-day operations. (As noted earlier, the current collection rate is not a good red-flag performer, no matter how renegotiated loans are treated: for operational management, the better choice is an on-time collection rate supplemented by a clean-up report for overdue amounts.)

[6] This entry in the register that calculates the collection rate does not correspond to the accounting treatment of the transaction. Rescheduling the original loan (simply extending its term) would usually produce no accounting entry. Refinancing the loan (replacing it with a new one) would be accounted for by showing a complete payoff of the old loan, not by cash, but by the new loan.

Prepayments. A similar but less bothersome issue is created by prepayments. If the client in our previous example makes her first two payments on time and then pays off the rest of her six-month loan on the third payment date, what happens in our register of payments due? One approach is to accelerate all the remaining payments due into the period when the loan is paid off. This treatment would seem best where the full outstanding loan balance is prepaid, because the loan disappears from the portfolio after that point.

Month	Amount due	Amount collected
1	100	100
2	100	100
3	400	400
Total	600	600

The alternative is to use the unorthodox rule mentioned above—tying the entries in the amounts-due register to the terms of the original loan contract:

Month	Amount due	Amount collected
1	100	100
2	100	100
3	100	400
4	100	0
5	100	0
6	100	0
Total	600	600

A reader with masochistic inclinations can find more discussion of collection rates in Richard Rosenberg, "Portfolio Quality Measurement in India's Regional Rural Banks" (1997). That paper proposes a manual (non-computerized) system for tracking a current collection rate. It can be found on CGAP's home page (http://www.worldbank.org/html/cgap/ cgap.html) or requested as an e-mail attachment from RRosenberg@worldbank.org.

D. Arrears Rates

$$\frac{\text{late payments}}{\text{total loans}}$$

Arrears rates are the second most common measure of microfinance delinquency. These rates focus on the amount of late payments, dividing this number by some measure of total loan activity—typically outstanding portfolio. Arrears rates tend to create an overoptimistic impression of portfolio quality.

In a sense, arrears rates compare apples with oranges: missed payments are compared not with payments due, but with total loan amounts. The problem is that payments that have fallen due may be small relative to total loan amounts. Thus an arrears rate is usually a small number, allowing managers and loan officers to remain complacent even when portfolio quality is deteriorating rapidly. Poor repayment can continue for a long time before the arrears rate becomes large enough to cause concern. Where an arrears rate is the only delinquency measure, problems often go unnoticed until it is too late to correct them.

The same point can be made from another perspective. When a client misses a payment on a loan, the MFI's risk increases. The arrears rate captures the increased risk that the payment in question will never be collected. But there is also an increased risk that the MFI will lose all the subsequent payments—the outstanding loan balance—as well. It is this latter risk, usually much larger, that the arrears rate fails to capture.

A stylized example illustrates how an arrears rate fails both our fire bell and bottom line tests. Suppose that on January 1 our MFI disburses a portfolio of 1,000 eight-year housing loans. The principal amount of each loan is 100. The loans are to be repaid in 96 monthly payments. In theory the loans are secured by the borrowers' houses, but in practice legal collection procedures are unreliable.

Now suppose that February 1 rolls by, and not a single one of the 1,000 borrowers makes a payment. The same thing happens again on March 1 and yet again on April 1. Our portfolio is clearly in desperate trouble: our clients' behavior on the first 3 payments casts strong doubts on our ability to recover the remaining 93. Yet the arrears rate on this portfolio would be only about 3 percent: on each loan, only 3 payments out of 96 are late—so far at least. (As this example illustrates, the distortive effect of an arrears rate is greater for loans with a large number of scheduled payments.)

For an MFI that wants to report really low delinquency, the arrears rate can be made even tamer by the simple expedient of defining "late" payments in the numerator very gently: some MFIs do not include a payment in the calculation until it is 30, 90, or 180 days late. Other programs don't count any payment as late until the entire term of the original loan has expired. By some of those measures, our stylized portfolio would appear 100 percent current.

The distortive potential of arrears rates is important enough to reiterate with a less extreme example. Consider the case of two clients who have each missed three payments. The first has a short-term working capital loan of 300, payable in 3 equal monthly installments. The second has an equipment loan of 3,600, payable in 36 monthly installments. Both clients have been unwilling or unable to make any payment so far. Thus both loans would be considered "nonperforming."

Measured against total portfolio, the three-month delinquency of the first client will have the same effect on the MFI's overall arrears rate as the three-month delinquency of the second client. But the outstanding balance at risk with the second client is 12 times the outstanding balance at risk with the first client. Credit managers need to discriminate between these two loans, because the second loan is much more worrisome than the first one. The arrears rate doesn't help them.

When delinquent loans are rescheduled or refinanced, most MFIs then treat the loan as being on time, with the result that the arrears accumulated under the original loan disappear from the arrears rate calculation. This situation can create an incentive for inappropriate rescheduling or refinancing, so the arrears rate does not do well on our smoke and mirrors test.

The longer a loan goes without payment, the less likely it is to generate income for the MFI, and the more likely it is to produce the extra expense associated with collections procedures. This is why loans eventually must be classified as nonperforming, even though they remain on the MFI's books throughout the collections period. Both managers and analysts need to know what percentage of the loan portfolio is producing normal income and expenses, and what percentage is generating minimal income and exceptional expenses. Arrears rates do not capture this information, and therefore fail our cash-flow test.

Occasionally someone defends arrears rates by pointing out that commercial banks use them. In the world of commercial banking, large long-term loans are usually supported by physical collateral or other security that provides an alternative source of loan recovery if the borrower fails to make the agreed payments. Thus commercial banks tend to be more relaxed than MFIs about on-time repayment. In fact, most banks don't even begin collection procedures until multiple payments have been missed. As a result, banks in many countries are allowed to use an arrears rate to report on loans that are up to 90 days late. Past 90 days, however, the loan is no longer treated as performing, and it has to be reported in a way that reflects that the full outstanding balance is at risk.

In microfinance, delinquency is more delicate. Amortization is more frequent. Loans become nonperforming more quickly, and most are uncollateralized. Once clients fall significantly behind, they often never become current again. An arrears rate simply does not reflect the true risk level of a microloan portfolio with substantial numbers of late payments, or one where a significant portion of loans have several missed payments.

Thus arrears rates almost always paint too rosy a picture of portfolio quality. This is not meant to imply that every MFI using an arrears rate is deliberately camouflaging its portfolio. In fact, the more common—and dangerous—occurrence is that the MFI is acting in good faith, with the result that the MFI is as much in the dark about its true portfolio quality as is the outside reader of its reports.

E. Portfolio at Risk

$$\frac{\text{outstanding balance of loans with overdue payment(s)}}{\text{total outstanding balance}}$$

The international standard for measuring bank loan delinquency is portfolio at risk (PAR). This measure compares apples with apples. Both the numerator and the denominator of the ratio are outstanding balances. The numerator is the unpaid balance of loans with late payments, while the denominator is the unpaid balance on all loans.[7] The PAR uses the same kind of denominator as an arrears rate, but its numerator captures all the amounts that are placed at increased risk by the delinquency.

A PAR can be pegged to any degree of lateness. PAR_{90}, a common measure among banks, captures the outstanding balance of all loans with a payment more than 90 days late. BancoSol in Bolivia reports PAR_0, recognizing a loan as delinquent the very next day after a payment is missed.

[7] As discussed later in this section, it may be technically more precise to exclude from the PAR denominator loans for which the first payment has not yet fallen due.

Compared to conventional banks, MFIs should arguably use a tighter definition of delinquency because their loans tend to be shorter term, their payments more frequent, and their delinquency more volatile. Recall our earlier stylized portfolio of housing loans, all of which had gone unpaid on the first three monthly due dates. PAR_{90} would not be a good red flag measure for this admittedly odd portfolio, because this measure would show a delinquency of zero. On the other hand, PAR_0, PAR_{30}, and PAR_{60} would all be 100 percent, delivering a clear message to management about the urgency of its problem. The message is not that 100 percent of the portfolio is going to be lost, but rather that 100 percent of the portfolio is at special risk. Estimating likely losses is discussed later.

Rather than tracking just one PAR indicator, MFIs should *age* their portfolios: that is, they should break them into groups by degree of lateness, as in the following example.

Payment status	Outstanding loan balance (share of total)	
Current	440,000	(88%)
1-7 days late[8]	30,000	(6%)
8-14 days late	15,000	(3%)
15-28 days late	10,000	(2%)
More than 28 days late	5,000	(1%)
Total	500,000	(100%)

If the MFI is a licensed financial institution, the public regulatory authority will probably prescribe the aging intervals to be used, at least for official reporting. An unregulated MFI can choose its own aging schedule. The period used—weekly, monthly, quarterly—should correspond to the repayment frequency of the MFI's loans. The aging schedule should also line up with break points in the MFI's loan collection process: for instance, if a loan is transferred from the loan officer to a supervisor when it becomes 28 days late, then 28 days should be a break point in the aging report.

An aged PAR like the example above works well as a red flag or a fire bell. This measure discriminates between loans where a payment is just barely late and much riskier loans that have been overdue a long time. It distinguishes a late payment that represents the last installment of a 24-month loan from one that represents the first. It gives proper relative weight to small and large loans, short- and long-term loans. Managers who receive a daily or weekly aged PAR report can quickly pick out loans that need to be pursued aggressively, while keeping a finger on the pulse of overall portfolio quality. No one indicator meets all needs or all situations, but an aged PAR is generally the single most useful indicator. Almost all MFIs should produce and use such a report.

Do PAR ratios meet our bottom line test? That is, do they generate information that allows us to estimate probable loan losses, in order to provision and price our portfolio? Many late loans are eventually paid, so having 10 percent of our portfolio late as of today doesn't mean that we'll ultimately lose all of the late loans. Even with PAR information, we still need to estimate what percentage of late loans will be lost, but the PAR report lets us make that estimate in a much more sophisticated manner. The longer a loan has been delinquent, the less likely we are to recover the unpaid balance. An aged PAR report breaks the portfolio into groups depending on the length of time loans have stayed delinquent, and allows us to assign different probabilities of loss to each group.

But how do we derive these loss probabilities? For a regulated financial institution, loss reserve percentages for external reporting are usually prescribed by the regulator. For instance, the Central Bank of Bolivia requires institutions it regulates to provision microcredit loan balances so as to maintain the following levels of loss reserves:

Payment status	Loss reserve percentage
Current or up to 5 days late	1%
6-30 days late	5%
31-60 days late	20%
61-90 days late	50%
More than 90 days	100%

Bolivia is unusual in having separate loss reserve rules for microloans. Most countries have a single reserve schedule, which has been set with normal commercial bank loan products in mind. These normative levels may be far too lax for microcredit portfolios, which tend to have shorter terms, more frequent payments, and no tangible collateral. A commercial bank might reasonably expect to recover a good percentage of secured loans

[8] The preferred method for time-sorting of overdue amounts is to compare the total amount of payments received with the amortization schedule in the loan contract. For instance, if principal payments of 100 are due each month, and only 200 in principal has been received by the tenth month, the loan would be eight months in arrears, regardless of when the last payment was received. See Von Pischke *et al.*, "Measurement of Loan Repayment Performance," Washington, D.C.: Economic Development Institute, 1988.

that are overdue by two quarterly payments; an MFI, on the other hand, could not expect to recover many of its 12-week uncollateralized loans that had gone 180 days without a payment. Thus an MFI, regulated or not, might need to provision more aggressively than bank regulations or conventional accounting practice would require.

A large MFI with a good portfolio information system may want to base its loss reserve percentages on a historical analysis. To do so the MFI would take a cohort of loans that are old enough so that it knows their final repayment outcome. It would then divide these loans into groups according to the degree of lateness they experienced, and determine what percentage of each group was ultimately collected. This produces an estimated percentage of loss for each interval in the MFI's aged PAR report. Before adopting these loss reserve percentages, the MFI needs to adjust them for circumstances—like seasonality, changes in the loan delivery methodology, or problems affecting the income of a large number of clients—that bear on the probability of loan recovery. Table 5 on page 17 illustrates the kind of loss reserve schedule that emerges from this analysis.[9]

Such historical loss analysis can be time-consuming or even impossible, especially for MFIs whose information systems do not retain old loan data in a usable form. New or small MFIs may choose a more elementary approach, simply estimating a flat percentage to use in provisioning all loans. For instance, an MFI might automatically provision 1 percent of all loan disbursements when they are made, or provision every quarter to keep its loan loss reserves at 2 percent of the outstanding portfolio. But even when such a blanket provisioning rule is used, the information system should support some kind of checking of present reserve levels against actual loss experience on the past portfolio, or at least against a projected loan loss level derived from a collection rate, as described above in section C.

A full discussion of provisioning is beyond the scope of this paper.[10] The relevant point here is that while PAR measures do not predict likely loan losses directly, they do provide a basis on which sophisticated provisioning for such losses can be done. In this sense, the PAR passes our bottom line test.

There is a simpler measure that, in MFIs at least, can approximate a PAR: percentage of active loan accounts overdue. This measure is the same as the PAR, except that it uses the number of accounts, which some MFIs can track more easily than the amount of those accounts. Use of this simplified measure is risky unless management has a good reason to believe that delinquency on larger loans behaves more or less the same as it does on smaller loans.

[9] For more discussion of historical provisioning, see Robert Peck Christen, *Banking Services for the Poor: Managing for Financial Success*, Washington, D.C.: ACCION International, 1997, pp. 42-67. This book can be ordered from the ACCION Publications Department, 733 15th Street NW, Suite 700, Washington DC 20005, USA; telephone (01) 202-393-5113, fax (01) 202-393-5115. A useful framework for analysis and presentation of historical delinquency experience and trends can be found in Jacob Yaron et al., *Rural Finance: Issues, Designs, and Best Practices*, World Bank Environmentally and Socially Sustainable Development Studies and Monographs Series 14, 1997, pp. 96-97.

[10] To tell the truth, a really full discussion of provisioning would be beyond the scope of the author's present knowledge as well.

Table 4 applies arrears rates and two types of PAR measures to a sample loan portfolio. Not surprisingly, what the portfolio looks like depends on the lens we use to view it.

Table 4: Delinquency as seen through three lenses

INDICATORS	Overdue 1-30 days	Overdue 31-90 days	Overdue 91+ days	Total overdue	Overdue on loans whose full term has expired
Arrears rate Value of late payments	12,904	6,583	6,094	25,581	1,462
As a share of outstanding portfolio (= 161,119)	**8.0%**	**4.1%**	**3.8%**	**15.9%**	**0.9%**
Portfolio at risk (PAR) Value of unpaid balance of delinquent loans	39,119	30,095	20,314	89,557	
As a share of outstanding portfolio (= 161,119)	**24.3%**	**18.7%**	**12.6%**	**55.6%**	
Simplified portfolio at risk Number of late loan accounts	8	7	5	20	
As a share of total active accounts (= 40)	**20.0%**	**17.5%**	**12.5%**	**50.0%**	

Adapted from Christen, p. 47; see note 9.

Using an arrears rate and defining payments as late only after expiration of the full loan term, an MFI would report this portfolio as having 0.9 percent delinquency—a number that would warm any auditor's heart. Treating loans as late after 90 days produces an arrears rate of 3.8 percent, which still sounds healthy. Even if payments are counted as late the day after a payment is missed, delinquency under the arrears rate lens shows at 15.9 percent, which sounds substantial but not catastrophic. But all these arrears rates seriously underestimate the risk of the portfolio. As the PAR analysis shows, the majority of the money owed to the MFI lies in loans that are at higher risk because they are late. One eighth of its portfolio is more than 90 days late. This MFI has a serious delinquency problem. (The policy at one large donor agency is not to fund any MFI whose PAR_{90} is above 10 percent.) The simplified PAR in Table 4 shows similar worrisome results. The percentage of accounts at risk is slightly lower than the percentage of amounts at risk, indicating that the MFI's larger loans are a little more likely to be delinquent. A final point illustrated by the table is that PAR ratios are meaningless unless a time period is specified: the PAR_0 of the sample portfolio is 55.6 percent, while its PAR_{90} is only 12.6 percent. Clearly, it is more revealing to report a range of PARs based on an aging of the portfolio, as in Table 4, rather than just a single ratio.

Like many other delinquency measures, the PAR can be distorted by improper handling of renegotiated loans. MFIs sometimes reschedule—that is, amend the terms of—a problem loan, capitalizing unpaid interest and setting a new, longer repayment schedule. Or they may refinance a problem loan, issuing the client a new loan whose proceeds are used to pay off the old one. In both cases the delinquency is eliminated as a legal matter, but the resulting loan is clearly at higher risk than a normal loan. Thus a PAR report must age renegotiated loans separately, and provision such loans more aggressively. If this is not done, the PAR is subject to smoke and mirrors distortion: management can be tempted to give its portfolio an artificial facelift by inappropriate renegotiation. Table 5 illustrates the proper process.

Table 5: Sample PAR report and loss reserve levels

	OUTSTANDING BALANCE		LOSS RESERVE	
	Share of total	**Amount**	**Percent**	**Amount**
Normal loans				
Current	86.2%	850,924	1%	8,509
1-30 days late	4.1%	40,713	10%	4,071
31-90 days late	2.1%	20,967	25%	5,242
91-180 days late	1.4%	14,026	50%	7,013
More than 180 days late	0.9%	8,645	100%	8,645
Subtotal	94.7%	935,275		33,480
Rescheduled and refinanced loans				
Current	3.8%	38,002	10%	3,800
1-30 days late	0.8%	8,215	25%	2,054
31-90 days late	0.4%	4,001	50%	2,001
More than 90 days late*	0.2%	1,712	100%	1,712
Subtotal	5.3%	51,930		9,566
Total	100.0%	987,205		43,047

*If a loan has been renegotiated more than once, it should automatically be included in the most delinquent category.

A disadvantage of the PAR measure is that it is dependent on accounting policy. When a loan is finally written off because the probability of recovery has become very low, the loan balance disappears from both the numerator and the denominator of the PAR fraction, lowering the value of the fraction. Thus failure to write off loans will inflate the PAR. An MFI in Guatemala carried all bad debts on its books for years and accumulated a PAR_0 of almost 15 percent. Nine out of ten of the problem loans were more than 180 days overdue, and therefore very unlikely to be collected. Had the MFI written off such loans each year, it would be showing a PAR_0 of less than 2 percent. But the MFI was unwilling to correct this distortion because the correction would involve a huge one-time loss on its income statement. The MFI continued to avoid writing off or provisioning its bad loans, thus overstating its income and assets while making its current portfolio appear worse than it really was.

Conversely, a crafty manager could generate a PAR measure as low as he wanted by adopting an artificially aggressive write-off policy—if he were reporting to a board or donor more concerned about delinquency than profitability. To give a full picture of portfolio quality, PAR measures must be viewed in conjunction with write-off experience.

Another potential distortion in PAR measures is worth mentioning. Arguably the PAR denominator should include only loans on which at least one payment has fallen due, so that late loans in the numerator are compared only to loans that have had a chance to be late. Nevertheless, it is customary to use the total outstanding loan balance for the denominator. The distortion involved is usually not large for MFIs, because the period before the first payment is a small fraction of the life of their loans. For instance, for a stable portfolio of loans paid in 16 weekly installments with no grace period, a PAR_7 of 5.0 percent measured with the customary denominator (total outstanding portfolio) would rise only to 5.3 percent using the more precise denominator (excluding loans on which no payment has yet come due.) However, if a portfolio is growing very fast, or if there is a grace period or other long interval before the first payment is due, then the customary PAR denominator can seriously understate risk.

To illustrate this dynamic, imagine a portfolio of 1,000 one-year loans payable in quarterly installments, and assume that half the clients fail to make their first payment on time. Intuitively, we might expect such a situation to produce a PAR_0 of about 50 percent. But now suppose that the portfolio is growing very fast, so that 500 of the loans have been disbursed in the past 90 days.

For these new loans, the first payment has not yet fallen due, so none of them has had a chance to be late. Of the 500 older loans, 250 are overdue. If we use the 1,000 total loans as our denominator, the simplified PAR_0 is only 25 percent, which substantially understates the actual frequency of problem loans in our portfolio. It would be more meaningful to include in the denominator only the 500 loans on which a payment had fallen due, yielding a more realistic PAR_0 of 50 percent.[11]

The PAR measure works only for loans that are repaid in installments. Consider a portfolio of crop loans that are to be paid in full at the end of their term. The first payment is also the last payment, so the loan disappears from the portfolio, and from the PAR calculation, when the payment is made. At any point in time a crop loan portfolio will consist exclusively of two types of loans: loans that have had no payment due, and loans that are overdue. For such a portfolio, a PAR of 15 percent conveys the irrelevant information that the outstanding balance of overdue loans is equal to 15 percent of the outstanding balance of loans not yet due. For such a portfolio, a more meaningful indicator would be a collection rate comparing amounts paid with amounts fallen due.

Finally, the loan methodology and accounting treatment in some village banking programs may not mesh well with a PAR measure. For instance, a disbursement to a 30-woman village bank will usually be booked as a single loan. An MFI will often accept partial payment from a group, especially if only 1 or 2 members out of 30 miss their installment. How is delinquency measured in this case? A standard PAR measure would treat the entire outstanding balance for all 30 women as being at higher risk, which seems overstated. The MFI would probably be better off using one or more collection rate indicators. One analyst proposes an interesting alternative for such situations: using an arrears rate, but provisioning a full 100 percent of all arrears.[12]

F. Disaggregating Delinquency Measurement

MFIs offering multiple loan products often do well in collecting one kind of loan but poorly in collecting another. Any delinquency measurement that lumps all loans together will obscure this important information. To the maximum extent possible, MFIs ought to be able to disaggregate delinquency information, not only by loan product, but also by region and branch, by loan officer, and in some cases by client characteristics or even by the time period during which the loan was first granted. This information can be extremely useful in tracking and managing a portfolio.

G. In a Nutshell

By now the reader may feel like the seven-year old student whose book review said, "This book told me more about whales than I wanted to know." On the first page of this paper the author observed that delinquency measurement can get complicated; perhaps he has illustrated this point too thoroughly. But amidst all the complexity, the important messages are really quite simple:

- Any mention of a delinquency ratio should include a precise description of the ratio's numerator and denominator—otherwise the ratio cannot be interpreted meaningfully, and may well suggest an unduly optimistic impression of portfolio quality.
- No single delinquency indicator works well for all MFIs.
- Most MFIs should track multiple delinquency indicators, because no indicator answers all the relevant questions.
- An MFI's outstanding portfolio tends to be roughly one half of the original disbursed amount of its loans.
- *Collection rates*, which divide amounts paid by amounts falling due during some period, are useful indicators but are subject to drastic misinterpretation: an MFI can have a 97 percent collection rate and still be losing a third of its portfolio every year.
- To estimate annual loan loss, a *current* or *cumulative collection rate* must be doubled and then multiplied by the average number of loan cycles per year.
- The most useful collection rate for day-to-day portfolio management is often an *on-time collection rate* that tracks success in collecting payments when they first fall due, supplemented by a *clean-up report* that tracks collection of late payments.

[11] This same dynamic occurs with arrears rates as well. If loans on which no payment has yet fallen due constitute a large percentage of the loan portfolio, any delinquency ratio that uses total portfolio (without excluding these loans) as its denominator will understate risk.

[12] William R. Tucker, "Measuring Village Bank Delinquency," unpublished manuscript, 1997.

- MFIs should avoid using the *Asian collection rate*, which includes past-due amounts from prior periods in the denominator of the ratio.
- Prepayments and late payments can create fluctuations that limit the usefulness of collection rates other than the on-time collection rate for measuring performance over a short period.
- Frequent renegotiation—rescheduling or refinancing—of problem loans makes it hard for an MFI to track and measure its repayment risk.
- Renegotiated loans should always be flagged and segregated from normal loans in a delinquency report.
- MFIs should usually not use *arrears rates*, which divide the amount of late payments by some measure of total portfolio or loan volume, because such measures tend to understate risk.
- Almost all MFIs should follow international banking standards by tracking and reporting *portfolio at risk (PAR)*: this measure analyzes outstanding balances of late loans as a percentage of total outstanding portfolio.
- MFIs with weak information systems may wish to use a *simplified PAR* based on the number of loan accounts rather than the amount of account balances.
- When tracking PAR it is useful to age the portfolio: loans are broken down by degree of lateness, using time intervals that correspond to the MFI's payment period and loan management process. Any PAR report should specify the time interval(s) being used.
- PAR information, supplemented by analysis of historical portfolio performance, can generate a sophisticated estimate of probable loan losses.
- In judging an MFI's portfolio quality, PAR information needs to be interpreted in light of the MFI's write-off policy and experience.
- PAR and arrears rates understate risk when a portfolio is growing very rapidly, or when there are long grace periods, unless loans on which no payment has yet fallen due are excluded from the denominator of the ratio.
- To the extent possible MFIs should disaggregate their delinquency measurement and reporting by loan product, region, branch, loan officer, and perhaps client characteristics.

Finally, for readers who like really concise summaries, here is the entire long-winded paper boiled down into a single table:

Table 6: Report card for common delinquency indicators

INDICATOR	TEST:* Red Flag	Fire Bell	Bottom Line	Smoke and Mirrors	Cash-Flow
On-time collection rate with clean-up report	++	+	-	-	-/+
Asian collection rate	-	-	-	-	-
Current collection rate with loan loss rate calculation	-	+	++	+	+
Cumulative collection rate with loan loss rate calculation	-	-/+	+	+	-/+
Arrears rate	+	-	-	-	-
Aged portfolio at risk with historical reserve schedule	+	+	+	-/+	-
Simplified portfolio at risk	+	+	-	-/+	-

*Red flag: highlights day-to-day operational issues
Fire bell: draws attention to major emergencies
Bottom line: permits estimate of actual loan losses likely to result
Smoke and mirrors: doesn't encourage inappropriate loan renegotiation or write-off policy
Cash-flow: helps management estimate cash receipts from portfolio in future periods

ANNEX: Converting Collection Rates into Annual Loan Loss Rates

The main text indicated that either a current collection rate or a cumulative collection rate can be used to estimate an annual loan loss rate, and provided a simplified formula for doing so. This annex provides a more precise treatment of that process.

The formula given in the main text was

$$(1)\quad ALR = \frac{1 - CR}{T} \times 2$$

where *ALR* is the annual loss rate (yearly loan losses divided by average outstanding loan portfolio); *CR* is the collection rate in decimal form; and *T* is the loan term, expressed in years.

Formula (1) owes its simplicity to an assumption that the outstanding balance of a given portfolio is equal to one half of the amount originally disbursed on the loans in that portfolio. How accurate that assumption is depends on the number of instalments in the loans' repayment schedules. Formula (2) adjusts for this factor: *N* is the number of payments per loan.

$$(2)\quad ALR = \frac{1 - CR}{T} \times 2 \times \frac{N}{N + 1}$$

The example presented in section C supposed a collection rate (*CR*) of 92.3 percent. The number of payments in a loan cycle (*N*) was 13, and the loan term (*T*) was three months, or 0.25 years. Application of Formula (2) gives us the same result we worked out above, an annual loss rate (*ALR*) of 57 percent of average outstanding portfolio:

$$.572 = \frac{1 - 0.923}{0.25} \times 2 \times \frac{13}{13 + 1}$$

Formulas (1) and (2) may overestimate the loss rate somewhat when the repayment schedule includes a long grace period, because in such a case average outstanding balance will be well above 50 percent of original principal amount. A similar distortion can occur if an MFI's portfolio is growing so fast that the distribution of loans is heavily skewed toward younger loans. In these cases Formula (3) can be used, where *PD* is the amount of principal that was disbursed under the loans presently in the portfolio, and *OB* is that portfolio's outstanding (unpaid) balance.

$$(3)\quad ALR = \frac{1 - CR}{T} \times \frac{PD}{OB}$$

All three of the above formulas depend on the loan term, expressed in years. In order to use any of them, an MFI that offers a variety of loan terms—for instance, some combination of three-month, six-month, and one-year loans—will need to estimate a weighted average loan term. Three methods can be used, depending on the information available.

Most MFIs can determine the average outstanding balance of their loan portfolio over the course of a year, by adding the start-of-year balance and the ending balances for all the months, and then dividing the total by thirteen. Likewise, it is usually easy to determine the total amount disbursed over the course of the year. Formula (4) indicates that the weighted average loan term (*T*) can be estimated by dividing the average outstanding balance (*AOB*) by total yearly disbursements (*YD*) and doubling the result.

$$(4)\quad T = \frac{AOB}{YD} \times 2$$

Formula (5) refines this estimate by adjusting it to reflect the average number of payments per loan (*N*).[13]

$$(5)\quad T = \frac{AOB}{YD} \times 2 \times \frac{N}{N + 1}$$

Suppose that an MFI's average outstanding loan balance (*AOB*) for the year is 250,000 while its loan disbursements for the year (*YD*) total 900,000. The average number of payments per loan (*N*) is 12. Formula (5) estimates that the weighted average loan term (*T*) is roughly 0.5 years, or six months.

$$0.51 = \frac{250{,}000}{900{,}000} \times 2 \times \frac{12}{12 + 1}$$

Finally, average loan term can also be estimated by a simple weighting scheme based on annual disbursed amounts for various types of loans. MFIs that don't have outstanding balance information available for their loan portfolio would have to use this method (they needn't feel bad, because it's the most accurate one). Suppose that over the course of a year an MFI disburses about 500,000 in one-year loans and 1,200,000 in three-month loans.

(A) Loan term in years	(B) Annual amount disbursed	(C) (A) times (B)
1.00	500,000	500,000
0.25	1,200,000	300,000
Total:	1,700,000	800,000

Dividing the total of column (**C**) by the total of column (**B**) produces a weighted average loan term of 0.47 years, or about six months.

[13] The MFI with a variety of loan products will need to estimate an average number of installments per loan (*N*) in order to use formulas (2) or (5). The author has fought off the temptation to burden this annex with a method for calculating this variable. His advice is simply to look at the portfolio and guess. Missing the mark on the number of installments won't alter the final loan loss estimate very much, since the value of N / (N+1) will be close to one unless the number of installments is very small. For instance, in the illustration following formula (2), the actual N is 13, and the resulting loss rate is 57.2 percent. If we grossly misjudge N and use 20 instead of the true value 13, the result of the calculation becomes 58.7 percent, hardly a material difference.

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