A Cost-Effectiveness Analysis of the Grameen Bank of Bangladesh

Mark Schreiner

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Microfinance Risk Management
6070 Chippewa St. #1W, St. Louis, MO 63109-3060, U.S.A.
Telephone: (314) 481-9788, http://www.microfinance.com
and
Center for Social Development
Washington University in St. Louis
Campus Box 1196, One Brookings Drive, St. Louis, MO 63130-4899, U.S.A.

Abstract

Reports of the success of the Grameen Bank of Bangladesh have led to rapid growth in funding for microfinance in both rich and poor countries. But has Grameen been cost-effective? This paper compares output with social cost for Grameen in a present-value framework. For a social investor in the time frame 1983-97, the cost of a person-year of membership in Grameen was about $20, and the cost of a dollar-year of borrowed purchasing power was about $0.22. Although the paper does not measure social benefits, most evidence in the literature suggests that benefits exceed these estimates of costs. Grameen—if not necessarily other microfinance organizations—was probably a good social investment.

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Author's Note

Mark Schreiner is Research Director at the Center for Social Development, Washington University in St. Louis. He studies ways to help the poor in the North and the South to build assets through savings and loans.

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1. Introduction

Microfinance—defined as efforts to improve access to loans and to saving services for poor people—may be the fastest-growing and most widely recognized new anti-poverty tool. A survey of 200 of the thousands of microfinance organizations found 13 million loans worth $7 billion and 45 million savings accounts worth $19 billion (Paxton, 1996). Growth will probably continue; for example, one movement seeks to raise more than $20 billion to provide microfinance to 100 million of the poorest families in the world by 2005 (Microcredit Summit, 1996).

The spark for microfinance is the story of the Grameen (Village) Bank of Bangladesh. Founded in 1976, by 1997 Grameen had a portfolio of $260 million and 2.3 million members, most of them very poor, more than 90 percent of them women, and all of them rural. More than 98 percent of payments due had been collected, and the average disbursement in 1997 was $170, 60 percent of per-capita income. Unlike many development projects in Bangladesh, Grameen has thrived through time and has relieved some of the misery caused by floods and cyclones, corruption, purdah norms that constrain women, and abysmal income and wealth.

Microfinance caught fire worldwide. In Bangladesh, Grameen clones have more than 2.5 million members. Transplants operate in the United States and Europe (Conlin, 1998; Rogaly et al., 1999) as well as Africa, other parts of Asia, and Latin America (Hulme, 1990; Thomas, 1995; Taub, 1998; Wall Street Journal, 1998).

Microfinance spread quickly across the globe because few other tools promise to fight poverty as effectively (Morduch, 1999a). But does microfinance really work? And if microfinance does work, then is it so effective that it should crowd out other types of development interventions (Rogaly, 1996)? After all, the poor benefit not only from better financial services but also, for example, from better food, water, roads, or shelter.

As it turns out, no one knows whether Grameen—let alone microfinance in general—has been cost-effective. Past attempts to measure the social costs of Grameen have flaws (Benjamin, 1994; Hashemi, 1997; Hulme and Mosley, 1996; Khandker et al., 1995; Morduch, 1999b; Yaron et al., 1997). Some count cash grants as revenue, some fail to impute an opportunity cost to all resources, and all fail to discount cash flows through time. Likewise, past attempts to measure the social benefits of Grameen have weaknesses (Hossain, 1988; Khandker, 1998 and 1996; Khandker et al., 1998; Latif, 1994; McKernan, forthcoming; Morduch, 1998; Nanda, 1999; Pitt et al., 1999; Pitt and Khandker, 1998; Schuler et al., 1997). Some fail to control for what would have happened even without Grameen, some fail to control for participant self-selection or for non-random placement of branches, and all fail to measure more than a few of the

multiple aspects of social benefits. These shortfalls result not from a lack of competence or effort but rather from the difficulty of the measurement of impact.

Has Grameen been a good social investment? If Grameen, one of the best microfinance organizations, has not been a good social investment, then most other microfinance organizations—and microfinance in general—might not be as useful as many have hoped.

This paper performs a cost-effectiveness analysis, comparing Grameen's outputs with its social costs in a standard present-value framework. Cost-effectiveness analysis is used because outputs are much simpler to measure than benefits. Social costs are taken as the present value of cash flows between public entities and Grameen.

From the point of view of a social investor from 1983-97, Grameen produced a person-year of membership at a cost of about $20. Likewise, Grameen produced a dollar-year of borrowed purchasing power at a cost of about $0.22. Most evidence in the literature suggests that social benefits (not measure in this paper) exceed these estimates of social costs. Thus, Grameen has probably been a good social investment. The results apply only to Grameen; other microfinance organizations—and microfinance in general—may or may not be as cost-effective.

Section 2 below outlines how Grameen works. Sections 3 and 4 present frameworks to measure the social benefits and social costs of microfinance. Section 5 discusses implications for Grameen and for the microfinance movement as a whole.

2. How Grameen works

Now this is how the birth of Grameen came about (Yunus, 1998). A young academic with a freshly minted PhD in economics from the United States had returned to Chittagong University to help to build his newly created country but grew frustrated with abstract theory as he watched people starve during the famine of 1974. One day in his quest to find a way to help, he met a bamboo weaver who, for want of less than $1, was enthralled to a moneylender. From his own pocket, the professor lent an average of $0.64 to the weaver and to 41 others. By 1976, Grameen was born. When Grameen became a bank in 1983, it had 36,000 members and a portfolio of $3.1 million.[1] By 1997, it had 2.3 million members and a portfolio of $260 million.

Behind the miracle story lies the design of products and incentives that allow Grameen to make small loans to poor people without physical assets for collateral. This section describes the design details that enabled the tale of success.

2.1 Membership

New members are placed in groups of five, with five to eight groups forming a centre. All members in the centre meet with a loan officer weekly. For the first few weeks, they learn about Grameen, save $0.02 a week, learn to sign their names, and

[1] All monetary figures are in dollars as of December 1998.

memorize a set of vows to self-improvement. Each group elects a chair, and each centre elects a chief. New members must also buy a share of stock in Grameen for $2.[2]

2.2 Loans

Lenders seek to manage default risk; all borrowers promise to repay, but, whether due to choice or to constraint, some break their promise. To control risk, most lenders require collateral, an asset that the borrower loses upon default and that thus motivates repayment. Most formal lenders require assets such as land or houses. The poor, however, either do not have such assets or cannot afford to lose them.

The innovation of Grameen—and of microfinance in general—is to collateralize the asset of future access to loans. Microfinance in the South works a lot like credit cards in the North; borrowers repay because they want to preserve their future access to loans.

Although Grameen did not invent the threat of termination as an incentive to fulfill contracts (Stiglitz and Weiss, 1983), it did popularize its combination with a second design element: default by one group member leads to loss of access for all members. This joint liability reduces risk in three ways (Conning, 1998). First, it gives members a self-interesed reason to exclude members who are known to be bad risks. Knowledge of individual character is costly to outsiders but is often a sunk cost for villagers. Thus, joint liability can cut the cost to screen potential borrowers. Second,

[2] In December 1998, 1 dollar was worth 48.5 taka.

members have an incentive to make sure that their fellows do not squander their loans. This can cut the cost to monitor active borrowers. Third, members have a reason to coax comrades out of arrears or even to repay their debts for them. Members may also act as mentors for each other. This can cut the cost to enforce repayment. On the downside, joint liability may lead to domino effects in which borrowers who would have repaid choose instead to default because they would lose access anyway due to the default of others (Besley and Coate, 1995; Paxton et al., 2000). Also, joint liability may not cut costs but rather only shift them from lenders to borrowers.

Because joint liability lets the poor bank on social capital, it has captured the imagination of the public (Zwingle, 1998). Because joint liability involves repeated games between heterogeneous agents with imperfect information, it has drawn attention from theoretical economists (Ghatak and Guinnane, 1999). At Grameen, however, joint liability is more subtle than the popular perception and more complex than the theory.

First, Grameen staggers disbursements to leverage the threat of termination. Two members get loans first, then two more members get loans one month later. After one more month, the last member gets a loan. Because most loans last exactly one year, staggered disbursement reduces the risk of domino default because some borrowers must finish repayment before they know whether their comrades will default. Furthermore, borrowers who have already paid most of their debt have incentives to make sure that their peers also repay.

Second, loan officers often do not enforce joint liability at the group level. They tend to bend the rules both because they know that some arrears are involuntary and because they are reluctant to kick out good borrowers. To enforce repayment without strict joint liability at the group level, loan officers use social pressure at the centre level. For example, they may suspend all disbursements at a centre until all debts are up-to-date. They may also scold women or detain them in the centre longer than normal. In Bangladesh, this shames women and may subject them to the wrath of their husbands when they finally are released (Ito, 1998; Rahman, 1999).

Third, Grameen implicitly promises bigger loans through time. New borrowers get very small loans, but loan size usually grows as they prove their creditworthiness. Most borrowers get a new loan as soon as they finish repayment on their old one.

Fourth and finally, Grameen promises more attractive types of loans to the best borrowers. The most common type of loan is the 'general' loan, but since 1984, Grameen has also made 'housing' loans with bigger disbursements, longer terms, and lower interest rates. Recently, Grameen started to make loans for college expenses and cell phones. Grameen even makes individual loans (Dowla, 1998). Access to these loans are worth a lot to borrowers, so the centres—and especially the centre chiefs—try to maintain a clean record.

2.3 Forced savings

Unlike most microfinance organizations, Grameen takes deposits. Saving is, however, compulsory, and some types of withdrawals are restricted. Saving in Grameen resemble insurance; members can borrow against their savings in emergencies, and Grameen can tap them in the case of default.

Grameen has four types of forced savings (Morduch, 1999c). The first two types are called 'savings', but they are really fees that members will never get back. After their first loan, members must pay 2 cents each week for schools run by the centre. They must also pay 0.5 percent of disbursements in excess of $20 into a fund used to cover losses from default.

The last two types of forced savings are real savings. Members must deposit four cents each week into 'personal savings'. Interest accrues at 8.5 percent, and withdrawals are unrestricted. In addition, 5 percent of each disbursement goes to the 'group fund'. Modelled on informal group funds (Ardener and Burman, 1995; Rutherford, 2000), it earns 8.5 percent and is supposed to be controlled by the centre and used for emergency loans to members. In practice, loan officers often control the fund, and they use it to insure Grameen against default (Matin, 1997). Grameen also makes loans from the 'group fund' after floods. Members cannot withdraw from the 'group fund' until they leave Grameen or until they have ten years of membership.

In sum, most 'savings' resemble fees for insurance or for loan-loss reserves. As members approach ten years of membership, however, the chance to withdraw what has grown to be a large sum is a strong incentive to continue to repay as promised.

Voluntary savings from members are small. This is unfortunate; to escape from poverty means to build assets. Although some people can build assets through debt, even more can build assets through savings. Some of the poor are creditworthy, but all are depositworthy. Grameen probably could improve its attempts to relieve poverty if it also had flexible, voluntary savings services decoupled from debt (Rutherford, 1998).

2.4 Non-financial products

Grameen aims to change the social and economic structure of rural Bangladesh. To do this, it supplies, in addition to loans, what it calls *discipline* (Khandker, et al., 1995). This is not only financial discipline to make repayments and deposits each week, but also physical discipline: members must sit in straight rows, salute, chant, and sometimes do calisthenics (Hashemi, 1997).

The vows that members recite also instill discipline in that they foster a break from the social norms that help to perpetuate misery in rural Bangladesh. For example, the resolutions praise small families, prohibit dowry and child marriage, promote gardens, extol education, and exhort members to drink clean water and to use latrines.

Perhaps the most important non-financial service of Grameen is *social intermediation* (Barton and Edgcomb, 1998). In essence, this produces social capital as

a by-product of meeting once a week. In rural Bangladesh, social capital is scarce because the custom of *purdah* isolates women from men and from markets. Grameen provides a socially accepted excuse to gather and to talk. The impacts are both psychological and economic; not only do women feel less isolated, but they also strengthen their support networks (Larance, 1998).

3. A framework to measure social benefits

What are the social benefits of the services just described? This section lays out a framework that integrates six linked (but distinct) aspects of social benefits: worth to users, cost to users, depth, breadth, length, and scope. Because worth, cost, and depth are difficult to measure, I adjust the framework to use only measurements of outputs. The general framework is useful for evaluation beyond microfinance.

3.1 Six aspects of social benefits

3.1.1 Worth to users

Worth to users is defined as their willingness to pay. This does not suppose that users can pay nor that they should pay. Rather, it supposes that a change in well-being due to microfinance can be expressed in dollar-equivalent terms. For example, if a woman were willing to bear costs of $50 to be a member of Grameen for a year, then she would be just as well off with $50 more income as with a costless year of membership. Worth is a simple concept, but it is very difficult to measure. The literature on Grameen does not contain any complete measure of worth to users.

3.1.2 Cost to users

Cost to users is defined as the sum of price costs and transaction costs. Price costs are direct cash payments to a microfinance organization. Price costs borne by users are revenue for the organization.

Transaction costs are non-price costs. They include both non-cash opportunity costs—such as the time to meet each week—and indirect cash expenses for such things as transport and documents linked to the use of microfinance. Transaction costs often swamp price costs (Bhatt and Tang, 1998). Transaction costs borne by users are not revenue for the microfinance organization.

The concepts of cost to users, cost of supply, and cost to society are distinct. Cost of supply is the opportunity cost of the resources used in production. Cost to society encompasses cost to users, cost of supply, and any other costs to non-users.

3.1.2.1 Estimates of costs to users of Grameen

Transaction costs can be estimated from survey data on the miles, minutes, and money involved in the use of microfinance. No one has estimated the transaction costs incurred in the use of Grameen.

Price costs are best estimated not as the nominal stated interest rate but rather as the real effective interest rate, defined as the annualized, inflation-adjusted discount rate such that the cash flows from the use of microfinance have a present value of zero. To estimate this for a typical borrower of Grameen requires several assumptions. First, inflation is 5 percent, the average in Bangladesh in 1988-97 (Table 1). Second, the member buys a share for 100 taka when she joins, and gets her first loan four weeks later. Third, she gets 10 'general' loans, each with an annual nominal stated interest rate of 20 percent (14 percent in real terms) and 52 equal installments that start one

week after disbursement. Fourth, the first loan is for 1,000 taka, and each subsequent loan increases by 1,500 taka. Fifth, the borrower makes all payments on time, makes no withdrawals from 'personal savings', and does not borrow from the 'group fund'. Seventh, the borrower leaves Grameen after ten years, sells her share, and withdraws the $150 accumulated in 'personal savings' and in the 'group fund'.

Given this, the present value of cash flows is zero when the weekly discount rate is 0.00711. The real effective interest rate is $(52 \cdot 0.00711 - 0.05)/(1+0.05) \doteq 30$ percent. Forced savings makes the real effective rate more than twice the real stated rate.

The accounting treatment of forced savings also affects Grameen's reported profits. Grameen counts cash inflows from all types of forced savings as increases in liabilities. If the non-reimbursable fees were correctly counted as revenue, then revenues and reported profits would increase even though cash flows for users would not change.

Why doesn't Grameen do this? Grameen probably wants to hide costs to users and to post low profits. Low interest rates differentiate Grameen from moneylenders. Furthermore, large profits might prompt the government to collect taxes and donors to ask whether the poor bear too much cost. The current structure provides strong cash flows without the appearance of excessive profits or high stated interest rates.

3.1.2.2 Net gain to users

Net gain to users is defined as worth minus cost, the change in well-being due to microfinance. Net gain is like consumer surplus in welfare theory, the difference between the highest cost that a user would agree to bear and the cost actually borne.

People join Grameen because they expect positive net gains. Although the size of net gain is unknown (because benefits are unmeasured), its sign can be inferred; if members do not drop out, then net gain must be positive. The annual drop-out rate at Grameen in 1986-94 was about 5 percent (Khandker et al., 1995). This suggests that most members had positive net gains.

3.1.3 Depth

Depth is defined as the social value of net gains that accrue to a given user. In welfare theory, depth is the weight of a user in the social-welfare function. If society has a preference for the poor, then poverty is a good proxy for depth.

In principle, only people in households with less than half an acre of land or with assets worth less than an acre of land can join Grameen. In practice, some new members exceed this limit (Matin, 1998). Most members are still very poor women.

3.1.4 Breadth

Breadth is defined as the number of users. Breadth matters because the poor are many but the development dollars are few. With more than 2.3 million members and centres in more than half the villages in Bangladesh, Grameen has extensive breadth.

3.1.5 Length

Length is defined as the time frame of the supply of microfinance. Length matters because society cares about the well-being of the poor both now and in the future. A common proxy for length is the ability to attract grants or soft loans or, in the absence of perpetual subsidies, the ability to earn enough profit to maintain the real value of equity (Schreiner and Yaron, 2001).

In 1997, Grameen reported a before-tax profit of $0.3 million. Without subsidies, losses would have been $23 million, and the sum of losses since 1983 would have been $183 million (Section 4 below). But Grameen does get subsidies, and it will continue to do so. Even if Grameen lost its subsidies, it probably could make the adjustments needed to survive long into the future.

3.1.6 Scope

Scope is defined as the number of types of services supplied. For example, a microfinance organization that offers both loans and savings services has greater scope than one that offers only loans. Scope also increases with the variety and flexibility of the terms of financial contracts.

Grameen has great scope in some ways and weak scope in others. Grameen does supply savings services, but almost all savings are forced, and withdrawal is restricted. For loans, the amount disbursed increases with time, and Grameen has invented new

types of loans to complement the 'general' loan. For a given type of loan, however, most terms are the same for all borrowers.

3.2 Benefit-cost analysis and cost-effectiveness analysis

As defined above, depth is the social value of net gain, or worth to users minus cost to users. Breadth is number of users, length is years of service, and scope is number of types of services. Next, the paper combines these six aspects in a formula that, in principle, could be used to measure the social benefits of microfinance.

Let t index length in years from 1 to T. Let s_t index scope as the number of types of services in year t from 1 to S_t. For a given service s_t in year t, let breadth be N_{ts}, with each user indexed by n_{ts}. Let the worth in year t of product s_t to user n_{ts} be w_{tsn}, and let the cost be c_{tsn}. Net gain is then $w_{tsn} - c_{tsn}$.

The depth function $D_{tsn}(w_{tsn} - c_{tsn})$ gives the social value of the net gain from contract s_t for client n_{st} in year t. The general social-welfare function $W(\cdot)$ aggregates net gains across users, services, and time:

$$\text{Social benefit} = b = W[D_{111}(w_{111} - c_{111}), \ldots, D_{TS_TN_{TS_T}}(w_{TS_TN_{TS_T}} - c_{TS_TN_{TS_T}})]. \quad (1)$$

Given a discount factor δ and the assumption that $W(\cdot)$ is additively separable across users, services,[3] and time, social benefits b is:

$$\text{Social benefits} = b = \sum_{t=1}^{T} \sum_{s=1}^{S_t} \sum_{n=1}^{N_{ts}} \delta^t \cdot D_{tsn}(w_{tsn} - c_{tsn}). \quad (2)$$

Benefit-cost analysis compares social costs c (Section 4 below) with social benefits b. If $b > c$, then a project passes the benefit-cost test and is deemed a good social investment. The test requires knowledge of worth to users w_{tsn}, cost to users c_{tsn}, and the social value of net gains $D_{tsn}(\cdot)$. Most analyses will not have this knowledge.

As an alternative, cost-effectiveness analysis compares social costs not with benefits but with outputs. Given that o_{tsn} is the number of outputs of type s_t for user n_{ts} in year t, cost-effectiveness replaces the measurement of social benefits b with the measurement of outputs Ω:

$$\text{Number of outputs} = \Omega = \sum_{t=1}^{T} \sum_{s=1}^{S_t} \sum_{n=1}^{N_{ts}} \delta^t \cdot o_{tsn}. \quad (3)$$

Most analyses consider only one service, so $S_t = 1$ for all t. Also, most projects have data on annual output but not on output for each user. If O_t is total output of one type of service in a year, then (3) is:

$$\text{Number of outputs} = \Omega = \sum_{t=1}^{T} \delta^t \cdot O_t. \quad (4)$$

[3] Of course, it may not always make sense to sum diverse types of outputs.

Define $\bar{b} = b/\Omega$ as (unmeasured) social benefit per unit of output, and define $\bar{c} = c/\Omega$ as (measured) social cost per unit of output. Dividing the benefit-cost criterion $b > c$ by Ω gives the cost-effectiveness criterion, $\bar{b} > \bar{c}$. A project is deemed cost-effective if unmeasured average social benefits $\bar{b}$ are judged to exceed measured average social costs $\bar{c}$.

Why bother with this algebraic rearrangement? After all, knowledge of average social costs does not confer knowledge of average social benefits. In the imperfect world of policy, however, criteria based on averages may be useful because often people can think about averages more easily than about aggregates. Furthermore, if average social costs are very high or very low, then policymakers may feel confident enough to judge whether unmeasured average social benefits exceed average social costs.

3.3 Discounted output of Grameen, 1983-97

Social costs c are estimated in Section 4. Here, the output Ω produced by Grameen in 1983-97 is estimated.

The discount factor $\delta = 1/(1+r)$, is the intertemporal social price. The choice of the social discount rate r is one of the most-debated issues in policy analysis. In practice, the two biggest entities that do project analyses—the World Bank and the US government—set r at 10 percent per year in real terms (Belli, 1996; US Office of Management and Budget, 1972). This is arbitrary, but with a fixed budget, its

consistent use leads to the correct choice of projects. Furthermore, funds seem to run out before projects whose benefits exceed costs at $r = 0.10$ (Quirk and Terasawa, 1991).

Of all the outputs of Grameen, this paper focuses on only two: person-years of membership and dollar-years of borrowed purchasing power. Membership confers access to all other services and so in some sense encompasses all of them. Dollar-years of borrowed purchasing power is the best summary of loan size because it accounts for the amount disbursed, the term to maturity, and the repayment pattern.

In a given year, the raw number of person-years of membership is the average number of members, and the raw number of dollar-years of borrowed purchasing power is the average net loan portfolio. It is more complex to discount these average stocks than to discount flows. Grameen, like most microfinance organizations, reports stocks only at the start (s_{t-1}) and end of a year (s_t). With linear change assumed, the daily average discount-weighted stock is not $\delta^{t-0.5} \cdot (s_t - s_{t-1})/2$ because the discount is a non-linear function of time. It turns out that:

$$\begin{aligned} \text{Disc. ave. stock} &= \delta_t^* \cdot (s_t - t \cdot \Delta s_t) + \delta_t^{**} \cdot \Delta s_t, \text{ where} \\ \delta_t^* &= (\delta^t - \delta^{t-1})/\ln \delta, \\ \Delta s_t &= s_t - s_{t-1}, \text{ and} \\ \delta_t^{**} &= (\ln \delta)^{-2} \cdot \{\delta^t \cdot (t \cdot \ln \delta - 1) - \delta^{t-1} \cdot [(t-1) \cdot \ln \delta - 1]\}. \end{aligned} \tag{5}$$

For $r = 0.10$ in 1983-97, Grameen produced 5.4 million discounted person-years of membership (line Eo in Table 5). Likewise, it produced 0.5 billion discounted dollar-years of borrowed purchasing power (line En). Is this a lot of output or a little? It depends on the social cost of its production.

4. A framework to measure social costs

Social cost is the sum of discounted cash flows from public entities to Grameen minus discounted cash flows from Grameen back to public entities, supposing that Grameen was founded in 1983 and liquidated in 1997. Past work uses *ad hoc* frameworks that do not discount.

If a microfinance organization is publicly owned, then social cost c is the equity E_0 that public entities put in the organization at time 0, plus the discounted net flows of funds FF_t from public entities and to organization in year t, minus the discounted equity E_T that public entities get back from the organization at time T:

$$\text{Social cost} = c = E_0 + \sum_{t=1}^{T} \delta^t \cdot FF_t - \delta^T \cdot E_T. \tag{6}$$

Measurement of E_0 and E_T is simple; the rest of this section describes how to measure FF_t.

4.1 Cash flows with public and private entities

The formula for social cost excludes all cash flows with private entities. Private entities are assumed to do their own cost-effectiveness analysis for whether a trade gives them net gains. The measure of social cost here ignores all private trades because they have, at worst, a social net gain of zero. It also assumes away all externalities.

In contrast, funds allotted by public entities belong to society. The price charged is not only set outside the market but may also lack any link to the social worth of funds in alternative uses. Cost-effectiveness analysis is useful to check the choices made by public servants who do not bear most of the consequences of their choices.

Public entities are funded involuntarily by taxpayers; private entities are funded voluntarily. Grameen has public funds because it sold stocks and bonds to the government of Bangladesh. Likewise, Grameen borrowed from the International Fund for Agricultural Development and from Norway and Sweden. Grameen also has private funds: debt from the Ford Foundation, and funds that came from Grameen members.

4.2 Financial statements

The cash flows of Grameen are derived from its financial statements.[4] This is

[4] For 1984-85, 1988-93, and 1996-97, financial statements come from the annual reports of Grameen. Data for the rest of the years come from Morduch (1999c), Hashemi (1997), and Khandker et al. (1995). Data for 1976-82 are unavailable. To convert stocks in nominal taka to constant dollars, the analysis multiplies nominal taka at time t by the consumer price index in Bangladesh as of 31 Dec 1998. It then divides by the consumer price index as of time t and multiplies by 1/48.5, the exchange rate between dollars and taka on 31 Dec 1998. Conversion of flows accounts for the fact that flows take place constantly even though only their sum is reported at year-end (Author, 1997).

problematic because accounting logic is seldom economic logic. To complicate matters, Grameen—like most other microfinance organizations—does not use generally accepted accounting principles. The adjustments below aim to remove most of the effects of this.

4.2.1 The accounting treatment of grants

Grameen treats some grants as liabilities. These funds, however, are really equity because they do not accrue interest and will not be paid back. The adjusted financial statements (Tables 2, 3, and 4), count these so-called liabilities as part of equity grants EG_t (line Di in Table 4). Equity grants are the vast bulk of net worth.

Grameen also counts some grants as revenue (RG_t, line Bp in Table 2). Because grants do not result from business operations, they are not revenue and should be counted as additions to equity. Counting grants as revenue inflates profit and blurs the picture of business performance.

4.2.2 Discounts on expenses

Almost all microfinance organizations receive some grants in kind. Common examples are fixed assets (land or computers) or services (technical assistance or debt guarantees). Free services are *discounts on expenses* (DX_t). They should be accounted for with two entries: an addition to equity (equal to the market value of the service), and an equal expense. Few organizations do this, however, and this inflates profits.

Grameen is exempt from reserve requirements on deposits; this is a discount on expenses because it reduces the cost of funds. The annual reports also hint at other

unquantified discounts. This paper assumes that discounts on expenses for Grameen are zero in all years (line Bu of Table 2).

4.2.3 Expenses for provisions for loan losses

Most banks recognize an expense for expected defaults as they make disbursements. This reflects the belief that loan losses are due not to weak enforcement but rather to weak screening. Thus standard practice is to charge an expense for expected loan losses not to the year when a loan turned sour but rather to the year when it was disbursed.

Grameen adjusts provisions for loan losses up or down each year to ensure a small reported profit. On net through time, it provisioned too little; $20 million in the reported net portfolio of $260 million at the end of 1997 probably will not be collected and yet did not have provisions.

This paper adjusts provisions so that the loan-loss reserve is always 5 percent of the gross loan portfolio (lines Cb and Cc of Table 3).[5] The adjustments include a write-

[5] Provisions are estimates of the loans that, although good now, will someday go bad. Data on cumulative disbursements and repayments for 'general' loans suggest that, as widely reported, Grameen has collected about 98 percent of funds disbursed and due. At the end of 1997, 'general' loans were 83 percent of the portfolio, and 'housing' loans were the bulk of the remainder. Because Grameen makes provisions at 5 percent of disbursements for 'housing' loans, provisions as a share of total

off each year of an amount equal to the provision expense in the previous year. The small reported profits become big losses in 1983-94 and big profits in 1995-97.

4.3 Other adjustments

4.3.1 Discount on public debt

The *discount on public debt* is defined as the savings that result from borrowing from a public source rather than from a private source. The discount is $D_t \cdot (m_t - c_t)$, where D_t is average public debt, c_t is the average interest rate paid for public debt, and m_t is the market interest rate for private debt of like risk. The market rate m_t always exceeds the public rate c_t; if not, the organization would not bother with public debt. The discount on public debt needlessly corrupts reported profits; with a cash equity grant of $D_t \cdot (m_t - c_t)$, an organization could pay for private debt, have the same net cash flows, and yet not depress interest expenses.

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disbursements should be $(1-0.98)\cdot 0.83 + 0.05 \cdot 0.17 \doteq 0.025$. Because 'general' loans have one-year terms, the amount disbursed in a year is about twice the balance outstanding. If 'housing' loans also had one-year terms, then provisions as a share of the balance outstanding would be twice provisions as a share of disbursements, or 5 percent. In fact, 'housing' loans have longer terms, so the balance outstanding is less than twice disbursement. In most years, however, Grameen has grown, and growth tends to make disbursements exceed twice the balance outstanding. Thus, 5 percent is a reasonable estimate of proper provisions as a share of balance outstanding.

The choice of the market interest rate m is as difficult as the choice of the social discount rate r. For Grameen, the cost of private debt in a free market in unknown because the government fixes the market rate at 14 percent and because the default risk of Grameen is unknown. To estimate m, this paper adjusts the prime rate for estimated risk.[6] On average in 1983-97, this risk-adjusted rate was 17 percent per year in nominal terms.

Like most other microfinance organizations, Grameen has a lot of public debt. In 1997, Grameen paid 5 percent for an average public debt of $187 million; the implied discount was $23 million (lines Fa-Fd of Table 6). The undiscounted sum of discounts on public debt through in 1983-97 was $152 million.

4.3.2 True Profit

True profit (TP_t) is defined as what reported profits P_t would be if the organization counted grants as additions to equity rather than as revenue grants RG_t, discounts on public debt $D_t \cdot (m_t - c_t)$, and discounts on expenses DX_t:

$$\text{True profit}_t = TP_t = P_t - [RG_t + D_t \cdot (m_t - c_t) + DX_t]. \quad (7)$$

True profit for Grameen is smaller than reported profit, mostly due to discounts on public debt. For example, reported profit in 1997 was $0.3 million, but true profit was -$23 million (line Fh of Table 6).

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[6] The algorithm comes from Benjamin (1994). It is assumed that Grameen would not replace public debt with deposits from members.

4.3.3 Ownership of shares

Most microfinance organizations are not-for-profits that do not sell shares nor have formal owners. Grameen does have shareholders, both public (the Bangladesh government) and private (members). This affects the cash flows that are assumed to come back to public entities at the end of the time frame because private entities will have a legal claim on some share of equity at liquidation.

Public paid-in capital (PC_{pubt}) is the stock of paid-in capital from public entities at time t, and private paid-in capital (PC_{prit}) is defined likewise. Public entities at time t have a legal claim on a share β_t of equity, where $\beta_t = PC_{pubt} / (PC_{pubt} + PC_{prit})$.

The government of Bangladesh bought all of the first issue of Grameen shares in 1983 (line Fi of Table 6). All subsequent sales have been to members. By 1997, β was 0.07, and equity was $84 million. If Grameen were liquidated, the government would receive $6 million, and the 2.3 million members would pocket $78 million, or $34 each. A $2 share bought in 1987 would have earned a nominal annual return of 33 percent. This handsome return is due to subsidies from public entities that bolstered equity but that then became the legal property of private shareholders.

4.3.4 Dividends and taxes

Unlike Grameen, some of the other top microfinance organizations have paid dividends, so the framework includes this possibility. The paper assumes that dividends Div_t are distributed throughout the year and that public entities get a share β_t.

Taxes are cash flows back to public entities. Until September 1996, Grameen was tax-exempt. In 1997, Grameen made provisions for tax on reported profits at the standard corporate rate of 40 percent. Of course, taxes are one more reason for Grameen to keep reported profits low.

4.4 The social cost of Grameen, 1983-97

Social cost is measured as discounted cash flows from public entities minus discounted cash flows back to public entities. The first outflow is the share of equity at time 0 that comes from public entities, $\delta^0 \cdot \beta_0 \cdot E_0 = \beta_0 \cdot E_0$.

Net flows of funds FF_t are the sum of the change in equity grants ΔEG_t, public paid-in capital ΔPC_{pubt}, revenue grants RG_t, discounts on public debt $D_t \cdot (m_t - c_t)$, and discounts on expenses DX_t, minus the public share of dividends $\beta_t \cdot Div_t$ and taxes:

$$FF_t = \Delta EG_t + \Delta PC_{pub_t} + RG_t + D_t \cdot (m_t - c_t) + DX_t - \beta_t \cdot Div_t - Tax_t. \quad (8)$$

This accumulated annual flow is discounted by δ_t^* (Author, 1997).

At the end of the time frame, public entities get an inflow of $\beta_T \cdot E_T$. Total social cost is then discounted outflows minus discounted inflows:

$$\text{Social cost} = \beta_0 \cdot E_0 + \sum_{t=1}^{T} \delta_t^* \cdot FF_t - \delta^T \cdot \beta_T \cdot E_T. \quad (9)$$

Assuming $E_0 = 0$, the social cost of Grameen for 1983-97 was $107 million (Line Fl in Table 6). To judge whether this is high or low requires a comparison with output.

5. Results and discussion

Was Grameen cost-effective? From 1983-97, it used $107 million to produce 5.4 million discounted person-years of membership, so the per-unit social cost was about $20 (line Fm of Table 6). This means that if members, on average in each year, were willing to bear at least $20 more cost than what they did in fact bear, then Grameen was a good social investment.

In terms of dollar-years of borrowed purchasing power, Grameen produced 0.5 billion discounted units, so the per-unit social cost was about $0.22 (line Fn of Table 6). These results are robust to the assumed social discount rate r and market interest rate m (Table 7).

Was Grameen worthwhile? The cost-effectiveness criterion requires that social benefits per unit of output $\bar{b}$ exceed social costs per unit of output $\bar{c}$. Although this paper has not estimated social benefits, the preponderance of the many imperfect and incomplete attempts to measure benefits strongly suggests that social benefits did indeed exceed this estimate of average costs.

5.1 Evidence of benefits of Grameen

At the most basic level, low drop-out rates signal that average social benefits were positive. Of course, a positive sign on average net gain is necessary but not sufficient for the size of average net gain to exceed average costs.

Several qualitative studies find that Grameen and/or its clones empower women (Amin et al., 1998; Hashemi et al., 1996). Larance (1998) finds that the weekly meetings help women to strengthen support networks beyond their kin groups. They also offer women a chance to gather in public and to hear their first names spoken with respect.[7] 'These findings suggest that the social implications of microcredit lending can be as powerful as—or even more powerful than—the economic implications' (Larance, 1998, p. 30). Both types of impacts are real and important even though both types remain unmeasured, at least in terms that can be directly compared with costs.

Other work finds that Grameen increases contraception (Schuler et al., 1994). Although Grameen does not supply family-planning services, its members do vow to keep their families small, and loan officers may prefer members with few children because they believe that children increase default risk. Increased contraception has social benefits, albeit unquantified and perhaps unquantifiable. Still, the gains are probably smaller than claimed; Schuler et al. (1994) do not control for non-random placement of branches nor for self-selection by participants. Pitt and Khandker (1996) do control for these factors, and they find that Grameen does not affect contraception.

In the economic sphere, the first study to use a control group (Hossain, 1998) found that membership in Grameen increased annual household income by 43 percent.

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[7] Empowerment is not costless; husbands sometimes beat their wives over conflicts related with Grameen (Rahman, 1999; Schuler et al., 1998).

Pitt and Khandker (1998) used different data and controlled for unobserved heterogeneity at the individual, household, and village levels. They found that annual household expenditure increased by $18 for each additional $100 of cumulative disbursement. If this effect persists through time and if the average effect exceeds the marginal effect, then the average increase in household expenditure by itself would provide at least $0.09 to balance the average social cost of $0.22 per dollar-year of borrowed purchasing power.

Pitt and Khandker (1998) also found that non-land assets of women increased by $27 for each additional $100 of cumulative disbursement. Furthermore, a 1 percent increase in cumulative disbursement to a woman increased the likelihood of school attendance by 0.028 for boys and by 0.019 for girls. These benefits, big as they may be, are not in flow units and so are not directly comparable to measures of average cost.

Morduch (1998) points out a flaw in Pitt and Khandker (1998); no controls own more than half an acre of land even though many new members of Grameen do. To correct this, Morduch drops from the sample all Grameen households with more than half an acre. He also replaces Pitt and Khandker's complex weighted exogenous sampling maximum likelihood/limited information maximum likelihood/fixed effects estimator with a simple difference-in-differences estimator. Finally, Morduch estimates the effects not of borrowing but of eligibility to borrow. The impacts found by Pitt and Khandker disappear. Morduch finds that access did, however, help to smooth

consumption and labour supply across seasons. This makes sense; loans help households to diversify activities, and Grameen also supplies implicit insurance. For subsistence households, a better buffer between them and hunger can be very valuable.

Khandker et al. (1998) use the data of Pitt and Khandker to find that the presence of a Grameen branch in a village increases the average wage by 14 percent and production per household by 50 percent.

McKernan (forthcoming) also uses this data and finds that participation in Grameen increases average profits from self-employment from about $45 per month to about $90 per month. Average monthly income for a four-person household in the sample is about $73, so this is a very large effect. These benefits alone would more than compensate for the social costs of supply.

Finally, Nanda (1999) uses the Pitt and Khandker data to find that Grameen increases the demand of women for formal health care. Indeed, Nanda claims that a given investment in microcredit has the same effect on the usage of formal health care as that same investment would have if used to establish of health clinics.

Each of these measurements of social benefits has weaknesses. If any one of them were correct, however, then social benefits probably exceed social costs. Although the true effects may be smaller than the biggest estimates, it is hard to imagine how impacts could not be positive in all these areas. This paper concludes that Grameen

was probably a cost-effective social investment. The goal has been to make explicit the logic and assumptions that support this judgement so that future work can improve it.

5.2 Implications for microfinance as a whole

What does the probable cost-effectiveness of Grameen mean for the worldwide microfinance movement that Grameen inspired? If Grameen, one of the best microfinance organizations, were a bad investment, then there would be little hope for most of the thousands of others. But Grameen probably was a good investment.

This does not mean that most other microfinance organizations are also good investments. Although Grameen's badness would condemn them, Grameen's goodness does not necessarily save them. One happy ending does not a microfinance movement make, and very few organizations perform as well as Grameen. Still, they may be good investments. Grameen offers hope; it did well, and so might microfinance in general. Future work should aim to replace hope with knowledge; after all, this paper can only guess that unmeasured benefits exceed measured costs.

Cost-effectiveness analysis is an inexpensive first step to improve allocations. For example, average costs may be compared across organizations with similar products, users, and contexts. All else constant, society prefers suppliers with lower average costs. Furthermore, although cost-effectiveness analysis does not identify those organizations with the highest benefits net of costs, it can help to detect grossly inefficient producers.

The research agenda should also include the measurement of two types of costs and benefits external to users. The first type of externality affects the family members or local competitors. The second type of externality accrues worldwide. The best (and worst) microfinance organizations inspire (and thwart) efforts and budgets far beyond their own markets and borders. Grameen may be a good social investment for its users, but no one knows yet whether the microfinance movement that it inspired will turn out to have been a worthwhile use of scarce funds earmarked for development projects.

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Table 1: Macroeconomic variables for Bangladesh and U.S.A., 1983-97

Line	For the year ended Dec. 31	Source	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Bangladesh																
Aa	Exchange rate (Tk/$)	Data	25.2	26.0	31.0	30.8	31.2	32.3	32.3	35.8	38.6	39.0	39.9	40.3	40.8	42.5	45.5
Ab	Bangladesh inflation	Data	12.0	8.6	18.4	10.6	11.1	5.9	8.6	11.8	1.9	1.5	4.0	4.7	3.6	4.1	3.6
Ac	Bangladesh inflation (Port. wgt. ave.)	Data	12.0	8.0	21.8	12.1	14.4	8.8	9.5	13.4	2.2	0.8	4.3	5.0	3.8	4.3	5.3
Ad	Bangladesh prime (Simple ave.)	Data	12.0	12.0	12.0	12.0	12.0	12.0	12.0	14.3	16.0	15.1	15.0	14.5	14.0	14.0	14.0
Ae	Bangladesh prime (Port. wgt. ave.)	Data	12.0	12.0	12.0	12.0	12.0	12.0	12.0	14.6	15.9	15.0	15.0	14.4	14.0	14.0	14.9
Af	Population (millions)	Data	93.9	95.6	97.4	99.2	101	103	105	107	109	111	113	115	120	122	124
Ag	GNP/capita (Dec. 1998 $)	Data	210	233	243	249	240	252	256	286	286	270	261	254	270	279	288
	USA																
Ah	USA inflation	Data	3.8	3.9	3.8	1.1	4.3	4.5	4.6	6.1	3.1	2.9	2.7	2.7	2.5	3.3	1.4
Ai	USA inflation (Port. wgt. ave.)	Data	3.8	3.6	3.8	1.3	12.8	4.5	4.5	6.0	3.1	2.8	2.6	2.7	2.5	3.3	1.8
Aj	USA prime (Simple ave.)	Data	NA	NA	10.0	8.4	8.2	9.2	10.9	10.0	8.6	6.3	6.0	7.0	8.8	8.3	8.4
Ak	USA prime (Port. wgt. ave.)	Data	NA	NA	9.9	8.3	8.3	9.4	10.9	10.0	8.4	6.2	6.0	7.2	8.8	8.3	9.0
Al	USA T-bill rate (Simple ave.)	Data	8.6	9.6	7.5	6.0	5.8	6.6	8.1	7.5	5.5	3.5	3.0	4.2	5.5	5.0	5.1
Am	USA T-bill rate (Port. wgt. ave.)	Data	8.7	9.6	7.4	5.9	5.9	6.8	8.1	7.5	5.4	3.4	3.0	4.3	5.5	5.0	5.4

Source: IMF and World Bank, various issues.

Table 2: Adjusted income statement of Grameen, 1983-97

Line	For the year ended Dec. 31	Source	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ba	Rev. Lending	Data	0.01	1.22	1.65	1.80	2.43	3.87	5.07	5.98	8.05	13.5	27.3	41.2	46.7	40.5	49.9
Bb	Rev. investments	Data	0.04	0.63	1.40	1.87	2.24	1.80	2.35	3.55	4.13	4.6	4.4	6.7	4.7	10.0	12.0
Bc	Exp. Int. deps.	Data	0.02	0.10	0.19	0.31	0.47	0.72	1.03	1.44	1.86	2.6	3.9	6.7	8.7	9.2	11.7
Bd	Exp. Int. private debt	Data	0.00	0.03	0.09	0.00	0.14	0.14	0.16	0.12	0.15	0.9	1.3	1.4	0.2	0.3	0.2
Be	Exp. Int. public debt	Data	0.06	0.70	1.10	0.97	0.69	0.81	1.05	1.14	0.93	0.9	2.8	7.5	8.0	8.2	8.4
Bf	**Fin. margin**	Ba+Bb-(Bc+Bd+Be)	(0.03)	1.02	1.67	2.40	3.38	4.00	5.18	6.83	9.23	13.6	23.7	32.2	34.5	32.7	41.7
Bg	Rev. Other op.	Data	0.00	0.00	0.00	0.03	0.02	0.02	0.08	0.08	0.20	0.2	0.3	0.7	0.5	0.3	0.4
Bh	Exp. Other op.	Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi	Exp. Loan-loss prov.	Data	0.22	0.40	0.46	0.64	1.12	1.64	2.12	2.47	2.88	5.2	10.8	13.1	12.7	12.1	14.3
Bj	Exp. Extraord. write-offs (net)	Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	(0.1)	(0.1)	(0.1)
Bk	Exp. Personnel	Data	0.08	0.49	1.18	1.79	2.44	2.78	3.79	4.96	7.25	10.1	15.0	14.7	16.8	18.3	21.6
Bl	Exp. administration	Data	0.09	0.24	0.39	0.52	0.89	1.91	2.83	3.31	3.03	3.2	3.9	5.8	4.2	4.5	5.1
Bm	Exp. Depreciation	Data	0.01	0.04	0.05	0.10	0.07	0.10	0.25	0.32	0.46	0.5	0.5	1.5	0.6	0.7	0.7
Bn	**Op. Margin**	Bf+Bg-(Bh+Bi+Bj+Bk+Bl+Bm)	(0.41)	(0.15)	(0.41)	(0.62)	(1.13)	(2.41)	(3.74)	(4.15)	(4.19)	(5.1)	(6.1)	(2.2)	0.8	(2.4)	0.4
Bo	Rev. Extraord. (net)	Data	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.5	0.5	0.0	0.0	0.0	0.0
Bp	Rev. grants, RG	Data	0.01	0.03	0.00	0.00	0.11	1.16	1.87	2.20	1.98	1.6	2.2	1.9	2.0	2.4	2.9
Bq	**Net income before taxes, P**	Bn+Bo+Bp	(0.40)	(0.11)	(0.41)	(0.62)	(1.01)	(1.25)	(1.87)	(1.95)	(2.02)	(3.0)	(3.3)	(0.3)	2.8	0.1	3.3
Br	Taxes on net income, Tax	Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bs	Dividends declared, Div.	Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Bt	**Change Retained earnings, RE**	Bq-(Br+Bs)	(0.40)	(0.11)	(0.41)	(0.62)	(1.01)	(1.25)	(1.87)	(1.95)	(2.02)	(3.0)	(3.3)	(0.3)	2.8	0.1	3.2
Bu	Note: Disc. op. exp., DX	Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Grameen and calculations of the author. Monetary figures in millions of Dec. 1998 $.

Table 3: Adjusted assets and liabilities of Grameen, 1983-97

Line	For the year ended Dec. 31	Source	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ca	Cash and short-term invest.	Data	2.2	8.5	10.2	17.8	15.1	14.4	21.1	31.1	40.7	38	53	86	96	145	107
Cb	Port. (gross)	Data	4.1	8.9	10.2	12.1	21.1	34.8	45.5	51.5	65.1	119	234	254	253	236	265
Cc	Reserve loan losses	Data	(0.2)	(0.4)	(0.4)	(0.6)	(1.1)	(1.6)	(2.1)	(2.3)	(2.9)	(5)	(11)	(13)	(13)	(12)	(13)
Cd	**Port. (net), LP**	Cb+Cc	3.9	8.5	9.8	11.5	20.0	33.2	43.4	49.2	62.2	113	223	242	240	224	252
Ce	Fixed assets (net)	Data	0.1	0.2	0.4	1.3	2.3	3.8	4.9	7.2	9.2	11	13	13	14	15	16
Cf	Long-term invest.	Data	0.0	0.0	0.0	0.0	0.0	5.2	8.5	7.2	5.1	3	3	0	0	0	0
Cg	Other assets	Data	0.2	1.4	2.3	3.3	5.2	3.2	5.1	7.1	3.7	3	2	25	44	34	31
Ch	**Total Assets**	Ca+Cd+Ce+Cf+Cg	6.4	18.7	22.7	33.8	42.7	59.8	83.1	102	121	169	294	365	394	419	406
Ci	Dep. libs	Data	1.0	2.0	3.4	4.8	7.7	10.8	15.3	20.4	27.1	39	69	78	82	87	99
Cj	Private debt	Data	0.1	0.1	2.0	0.2	2.1	0.6	2.0	1.8	1.8	2	2	2	4	11	6
Ck	Public debt	Data	4.6	15.8	16.7	27.8	31.5	40.3	52.0	49.8	48.6	48	137	197	195	197	177
Cl	Other Libs.	Data	0.0	0.0	0.0	0.8	1.9	2.3	3.0	4.6	4.9	7	16	27	36	35	40
Cm	**Total Libs.**	Ci+Cj+Ck+Cl	5.8	17.9	22.2	33.5	43.2	54.0	72.4	76.7	82.4	96	224	305	318	330	322

Source: Grameen and calculations of the author. Monetary figures in millions of Dec. 1998 $.

Table 4: Adjusted equity of Grameen, 1983-97

Line	For the year ended Dec. 31	Source	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Da	Start Retained earnings	Dc(t-1)	0.00	(0.40)	(0.52)	(0.92)	(1.55)	(2.56)	(3.81)	(5.68)	(7.63)	(9.7)	(12.6)	(15.9)	(16.2)	(13.4)	(13.4)
Db	Change Retained earnings, RE	Bt	(0.40)	(0.11)	(0.41)	(0.62)	(1.01)	(1.25)	(1.87)	(1.95)	(2.02)	(3.0)	(3.3)	(0.3)	2.8	0.1	3.2
Dc	**End Retained earnings**	Da+Db	(0.40)	(0.52)	(0.92)	(1.55)	(2.56)	(3.81)	(5.68)	(7.63)	(9.65)	(12.6)	(15.9)	(16.2)	(13.4)	(13.4)	(10.2)
Dd	Start Reserves and adj.	Df(t-1)	0.00	0.20	0.23	0.16	0.15	0.19	0.30	(0.06)	(0.99)	(1.5)	(1.7)	(3.8)	(6.6)	(8.1)	(10.6)
De	Change Reserves and adj.	Data	0.20	0.03	(0.08)	(0.01)	0.04	0.10	(0.35)	(0.94)	(0.46)	(0.3)	(2.1)	(2.8)	(1.5)	(2.5)	(4.1)
Df	**End Reserves and adj.**	Dd+De	0.20	0.23	0.16	0.15	0.19	0.30	(0.06)	(0.99)	(1.45)	(1.7)	(3.8)	(6.6)	(8.1)	(10.6)	(14.7)
Dg	Start Equity grants	Di(t-1)	0.00	(0.17)	(0.27)	(0.30)	(0.07)	(0.15)	6.83	13.49	30.87	45.6	83.0	84.7	76.3	91.0	105.8
Dh	Change Equity grants, EG	Data	(0.17)	(0.10)	(0.03)	0.22	(0.07)	6.98	6.66	17.37	14.76	37.4	1.7	(8.4)	14.7	14.8	(4.2)
Di	**End Equity grants**	Dg+Dh	(0.17)	(0.27)	(0.30)	(0.07)	(0.15)	6.83	13.49	30.87	45.62	83.0	84.7	76.3	91.0	105.8	101.6
Dj	Start Paid-in cap. public	Dl(t-1)	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0	1.0	1.0	1.0	1.0	1.0
Dk	Change Paid-in cap. public, PCpub	Data	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0
Dl	**End Paid-in cap. public**	Dj+Dk	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.0	1.0	1.0	1.0	1.0	1.0
Dm	Start Paid-in cap. private	Do(t-1)	0.00	0.00	0.37	0.57	0.79	1.02	1.51	1.97	1.97	3.1	4.0	4.1	5.7	5.9	6.0
Dn	Change Paid-in cap. private, PCpri	Data	0.00	0.37	0.21	0.21	0.23	0.49	0.46	0.00	1.14	0.9	0.0	1.6	0.2	0.1	0.3
Do	**End Paid-in cap. private**	Dm+Dn	0.00	0.37	0.57	0.79	1.02	1.51	1.97	1.97	3.11	4.0	4.1	5.7	5.9	6.0	6.3
Dp	**Total Equity**	Dc+Df+Di+Dl+Do	0.63	0.81	0.51	0.32	(0.50)	5.83	10.73	25.21	38.63	73.6	70.0	60.2	76.4	88.9	84.1

Source: Grameen and calculations of the author. Monetary figures in millions of Dec. 1998 $.

Table 5: Discounted outputs of Grameen, 1983-97

Grameen: Discounted outputs

Line	For the year ended Dec. 31	Source	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ea	Net portfolio outstanding	Cd	1.95	3.92	8.52	9.75	11.5	20.0	33.2	43.4	49.2	62.2	113	223	242	240	224	252
Eb	Members outstanding (thousands)	Data	30.4	58.3	121	172	234	339	490	662	870	1,066	1,424	1,815	2,013	2,066	2,060	2,273
Ec	Change in portfolio in year	Ea-Ea(t-1)	NA	1.966	4.598	1.238	1.773	8.508	13.17	10.24	5.711	13.06	51.04	110	18.26	-1.516	-15.61	27.4
Ed	Change in members in year (thousands)	Eb-Eb(t-1)	NA	27.9	62.73	50.57	62.72	104.8	151.2	171.9	207.3	196.9	358	390.5	198.2	52.53	-6.151	213
Ee	Social discount rate, r	Data	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Ef	Social discount factor, Delta	1/(1+Ee)	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909	0.909
Eg	Natural log of Delta	ln Ef	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095
Eh	Year t	Eh(t-1)+1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ei	Delta^t	Ef^Eh	1.000	0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467	0.424	0.386	0.350	0.319	0.290	0.263	0.239
Ej	Delta*t	[Ei-Ei(t-1)]/Eg	NA	0.954	0.867	0.788	0.717	0.651	0.592	0.538	0.489	0.445	0.405	0.368	0.334	0.304	0.276	0.251
Ek	Delta**t	Eg^(-2)*{Ei*(Eh*Eg-1)-Ei(t-1)*[(Eh-1)*Eg-1]}	NA	0.469	1.294	1.964	2.502	2.926	3.253	3.495	3.667	3.779	3.84	3.858	3.842	3.797	3.728	3.64
El	Disc. portfolio	Ej*(Ea-Eh*Ec)+Ek*Ec	NA	2.78	5.36	7.19	7.61	10.2	15.7	20.6	22.6	24.7	35.3	61.6	77.6	73.2	64.2	59.8
Em	Disc. members	Ej*(Eb-Eh*Ed)+Ek*Ed	NA	42.1	77.3	115	145	186	245	310	374	430	503	594	639	620	570	544
En	Accum. disc. portfolio	En(t-1)+El	0	2.78	8.14	15.3	22.9	33.2	48.9	69.5	92.1	117	152	214	291	365	429	489
Eo	Accum. disc. members (thousands)	Eo(t-1)+Em	0	42.1	119	234	380	566	811	1,120	1,494	1,924	2,427	3,022	3,661	4,281	4,850	5,394

Source: Grameen and calculations of the author. Monetary figures in millions of Dec. 1998 $.

Table 6: Social cost and cost-effectiveness of Grameen, 1983-97

Line	For the year ended Dec. 31	Source	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Fa	Ave. Public debt, D	[Ck(t-1)+Ck]/2	NA	2.30	10.2	16.2	22.2	29.6	35.9	46.2	50.9	49.2	48.2	92.6	167	196	196	187
Fb	Rate paid public debt, c	Be/Fa	NA	0.03	0.07	0.07	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.05
Fc	Market rate for private debt, m	Data	NA	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Fd	**Disc. public debt, D*(m-c)**	Fa*(Fc-Fb)	NA	0.33	1.03	1.66	2.82	4.35	5.29	6.80	7.51	7.43	7.24	13.0	20.9	25.3	25.1	23.4
Fe	Net income before taxes, P	Bq	NA	(0.40)	(0.11)	(0.41)	(0.62)	(1.01)	(1.25)	(1.87)	(1.95)	(2.02)	(2.99)	(3.31)	(0.26)	2.78	0.07	3.32
Ff	Rev. grants, RG	Bp	NA	0.01	0.03	0.00	0.00	0.11	1.16	1.87	2.20	1.98	1.61	2.25	1.91	1.97	2.44	2.90
Fg	Disc. op. exp., DX	Bu	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fh	**True profit, TP**	Fe-(Ff+Fd+Fg)	NA	(0.74)	(1.17)	(2.07)	(3.44)	(5.48)	(7.70)	(10.5)	(11.7)	(11.4)	(11.8)	(18.5)	(23.1)	(24.5)	(27.4)	(22.9)
Fi	Public share of paid-in capital, Beta	Data	0	1.00	0.71	0.60	0.51	0.43	0.32	0.25	0.25	0.16	0.12	0.12	0.08	0.08	0.08	0.07
Fj	Beta0*E0	Fi0*Dp0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fk	Accum. disc. fresh funds	Fk(t-1)+Ej*(Dh+Dk+Bp+Fd+Bu-Fi*Bs-Br)	0	1.11	1.94	3.23	5.41	8.27	16.2	24.5	37.7	48.5	67.2	73.4	78.2	91.0	103	108
Fl	Social cost	Fj+Fk-Fi*Ei*Dp	NA	0.54	1.47	3.01	5.30	8.41	15.2	23.1	34.8	45.9	63.8	70.5	76.7	89.3	100.9	107
Fm	Social cost/person-year of membership ($)	Fl/(Eo/1000)	NA	12.8	12.3	12.8	14.0	14.9	18.7	20.6	23.3	23.9	26.3	23.3	20.9	20.9	20.8	19.8
Fn	Social cost/dollar-year of debt ($)	Fl/En	NA	0.19	0.18	0.20	0.23	0.25	0.31	0.33	0.38	0.39	0.42	0.33	0.26	0.24	0.24	0.22

Source: Grameen and calculations of the author. Monetary figures in millions of Dec. 1998 $.

Table 7: Sensitivity of average cost per person-year of membership

	m															
r	**0**	**0.01**	**0.03**	**0.05**	**0.07**	**0.09**	**0.11**	**0.13**	**0.15**	**0.17**	**0.19**	**0.21**	**0.23**	**0.25**	**0.27**	**0.29**
0.00	5.1	5.8	7.4	9.0	10.6	12.2	13.8	15.3	16.9	18.5	20.1	21.7	23.2	24.8	26.4	28.0
0.02	5.4	6.2	7.7	9.3	10.9	12.5	14.0	15.6	17.2	18.8	20.4	21.9	23.5	25.1	26.7	28.2
0.04	5.7	6.5	8.0	9.6	11.2	12.8	14.3	15.9	17.5	19.0	20.6	22.2	23.8	25.3	26.9	28.5
0.06	6.0	6.8	8.3	9.9	11.5	13.0	14.6	16.2	17.7	19.3	20.9	22.4	24.0	25.6	27.1	28.7
0.08	6.2	7.0	8.6	10.2	11.7	13.3	14.9	16.4	18.0	19.6	21.1	22.7	24.3	25.8	27.4	29.0
0.10	6.5	7.3	8.8	10.4	12.0	13.5	15.1	16.7	18.2	19.8	21.4	22.9	24.5	26.1	27.6	29.2
0.12	6.7	7.5	9.1	10.6	12.2	13.8	15.3	16.9	18.5	20.0	21.6	23.1	24.7	26.3	27.8	29.4
0.14	6.9	7.7	9.3	10.8	12.4	14.0	15.5	17.1	18.7	20.2	21.8	23.4	24.9	26.5	28.1	29.6
0.16	7.1	7.9	9.4	11.0	12.6	14.1	15.7	17.3	18.8	20.4	22.0	23.6	25.1	26.7	28.3	29.8
0.18	7.2	8.0	9.6	11.1	12.7	14.3	15.9	17.4	19.0	20.6	22.2	23.7	25.3	26.9	28.5	30.0
0.20	7.3	8.1	9.7	11.3	12.9	14.4	16.0	17.6	19.2	20.7	22.3	23.9	25.5	27.1	28.6	30.2
0.22	7.4	8.2	9.8	11.4	13.0	14.5	16.1	17.7	19.3	20.9	22.5	24.0	25.6	27.2	28.8	30.4
0.24	7.5	8.3	9.9	11.4	13.0	14.6	16.2	17.8	19.4	21.0	22.6	24.2	25.8	27.4	28.9	30.5
0.26	7.5	8.3	9.9	11.5	13.1	14.7	16.3	17.9	19.5	21.1	22.7	24.3	25.9	27.5	29.1	30.7
0.28	7.5	8.3	9.9	11.5	13.1	14.7	16.3	17.9	19.6	21.2	22.8	24.4	26.0	27.6	29.2	30.8
0.30	7.5	8.3	9.9	11.5	13.1	14.7	16.4	18.0	19.6	21.2	22.8	24.4	26.1	27.7	29.3	30.9

Source: Author's calculations.