Economics and Sociology
Occasional Paper No. 2361

How to Measure the Subsidy Received By a Development Finance Institution

by

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First draft: May 2, 1997

Revised: May 27, 1997

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Abstract

The most common indicator of the financial performance of development finance institutions, the Subsidy Dependence Index of Yaron (1992a), fails to recognize that subsidies are like equity injections whose use over time has a cost. Thus, the SDI underestimates subsidy. This paper gives a modified framework that counts all subsidies as equity injections. The paper also recasts the traditional SDI formula to clarify its definition and to show its invariance with respect to the form of subsidized resources. The modified framework is applied to the Grameen Bank in Bangladesh and to Caja los Andes, a microfinance organization in Bolivia. The underestimation of the traditional measure is material. The modified framework could be applied to any subsidized organization.

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1. Introduction

1.1 Why measure subsidy?

The goal of development finance institutions is to improve the welfare of the poor people who buy its financial services. This is so whether the DFI is a microfinance NGO or whether it is a public development bank. A big cog in this goal is self-sustainability (Krahnen and Schmidt, 1994). In turn, self-sustainability hinges on financial self-sufficiency (Khandker *et al*., 1995). A subsidized DFI is financially self-sufficient if it could provide the same services without subsidy.

Measuring subsidy matters because measuring financial self-sufficient matters. Financial self-sufficiency means the DFI would not shrink if it had to pay market prices for all its resources. Financial self-sufficiency matters because access to subsidized resources waxes and wanes with the whims of donors. If a DFI is not financially self-sufficient when donors withdraw, then it will shrink. Eventually, it will die and abandon its clients.

An indicator of financial self-sufficiency is more practical than a full-blown benefit-cost analysis. Measuring financial self-sufficiency requires measuring social costs, which is cheap, but benefit-cost analysis requires measuring benefits, which is costly (Von Pischke and Adams, 1980; David and Meyer, 1980). For transactions between DFIs and donors, financial self-sufficiency implies that social benefits exceed social costs because the DFI could compensate society for its costs. For transactions between DFIs and clients, the benefits must exceed the costs or else the clients would buy financial services elsewhere. If no one loses, then everyone wins.

A DFI is subsidized if society, through donors, entrusts it with subsidized resources. Subsidized resources have below-market prices and come involuntarily from taxpayers. The expenses of an unsubsidized DFI are more than the expenses of an otherwise-identical subsidized DFI. The difference is the subsidy, a cost not counted as an expense.

Donors want to measure subsidy because they want to know how far the fledgling DFI could fly in the market. Donors want to know this for least three reasons. Each reason boils down to the scarcity of donor resources compared to the abundance of better welfare wanted by poor people.

The first reason donors want to measure subsidy is because a financially self-sufficient DFI could attract capital from selfish private investors. Private capital would free donors to ply their trade elsewhere. In addition, there is more private capital than donor capital, so private capital could expand development finance to many times the size possible with only donor capital (Rosenberg, 1994).

The second reason donors want to measure subsidy is because the DFIs are many but the donor dollars are few. Donors want to allocate resources earmarked for development finance to the DFIs with the biggest bang for the buck.

The third reason donors want to measure subsidy is because development finance is only one of many ways society could improve the welfare of the poor. Donors want to allocate resources to the use—development finance, sports stadiums, or primary education for girls—with the biggest bang for the buck.

Like donors, the managers of a DFI also want to measure subsidy. Managers care about subsidy not because they care so much for the welfare of the poor but rather because they care about their own jobs. Employees at DFIs usually enjoy unusually high pay and the perk of warm feelings from helping the poor. There are few jobs so good in low-income countries. If donors withdraw and the DFI shrinks and dies, then managers will lose their good jobs. Thus, managers want to measure subsidy to know how far they are from being able to survive donor withdrawal.

Financial self-sufficiency is seen from the point of view of the DFI. The opportunity cost of subsidized resources from the point of view of the DFI is less than the opportunity cost of resources from the point of view of donors or of society. Still, because the opportunity cost of the DFI probably is more than the opportunity cost of society, financial self-sufficiency from the point of view of the DFI implies worthwhileness from the point of view of society. Financial self-sufficiency is sufficient, but not necessary, for the social benefits of a DFI to be more than social costs.

1.2 How is subsidy measured now?

The most common indicator of the financial performance of development finance institutions is the Subsidy Dependence Index (Yaron 1997; 1994; 1992a; 1992b). The SDI eschews the accounting point of view of a subsidized DFI. Instead, the SDI takes the economic point of view of a hypothetical unsubsidized DFI. The financial statements of subsidized DFIs usually ignore subsidies or handle them in arbitrarily. In addition, expenses for the use of subsidized resources reflect below-market prices. Thus, the expenses in the financial statements are smaller than the opportunity cost of the subsidized resources to the DFI. The genius of the traditional SDI is to inject economic logic into the accounting information using the assumed opportunity cost of subsidized resources to the DFI.

The gist of the traditional SDI (SDI^T) framework is the calculation of subsidy (S^T). The SDI^T is the "percentage increase in the [DFI's] average on-lending interest rate required to compensate for the elimination of subsidies" (Yaron, 1992a, p. 16). This is a linear function of S^T. The SDI is a ratio of compensated subsidy to revenue from lending:

$$SDI^{T} = \frac{Compensated\ subsidy}{Rev.\ from\ lending} = \frac{Subsidy - True\ profits}{Rev.\ from\ lending}. \qquad (1)$$

The compensated subsidy CS^T is the subsidy net of the transfer of resources that would be needed to keep the same services without subsidized resources and with zero profit.

The SDI^T is simple, and its logic is common sense. It is widely accepted, and it has become the center of any serious analysis of the performance of DFIs (*e.g.*, Hashemi (1997); González-Vega, *et al.*, 1997a; Chaves and Quiròs, 1996; Khandker *et al*., 1995; Schreiner and González-Vega, 1995; Gurgand, *et al.*, 1994). In fact, the belief that microfinance can reach the masses self-sustainably is based mostly on SDI^Ts (Christen *et al*. 1995, Benjamin, 1994).

Despite the simplicity and popularity of the SDI^T, some changes have been proposed. The changes of Khandker *et al.* (1995) are shown by Morduch (1997) to be mistaken. Cosmetic changes to the traditional SDI have been proposed by SEEP (1995), the Inter-American Development Bank (1994), and Holtmann and Mommartz (1996).

Christen (1997) and Benjamin (1994) improve the SDI^T materially. Christen (1997) adjusts the income statement so that expenses include the opportunity cost to the DFI of subsidized resources. He also removes grants from revenue. This creates financial statements amenable to the traditional techniques of financial analysis for commercial banks. This opens the door to peer comparisons, an important management tool and motivator (Richardson, *et al*., 1993; Koch, 1992). Christen does not, however, recognize that subsidized equity can be more than the total accounting equity. Benjamin (1994) considers the different risk premia of debt and equity, an important and necessary complication first suggested by Yaron (1992b).

1.3 How should subsidy be measured?

From an economic point of view, all subsidies are like to equity injections. This paper modifies the SDI^T to account for this fact. A DFI that is financially self-sufficiency could pay the same return to society for an injection of equity as the DFI would have to pay to a private investor. This return is the opportunity cost of the DFI, and it is also the opportunity cost of the private investor. It is the return the private investor could have expected from an investment of like risk.

S^T is a lower bound on the DFI's expenses if it replaced subsidized resources from donors with equivalent unsubsidized resources from the market. In reality, the DFI does not pay a market price for the use of its subsidized resources. Therefore, it is as if the DFI got another transfer of subsidized resources equal to the subsidy that was not paid. This follows from the logic of the SDI^T framework itself.

The SDI^T framework ignores this implicit equity injection. The modification proposed here just takes the logic of the traditional framework to its full end. Private entities would not entrust resources to a DFI unless the DFI paid the opportunity cost of the resources in the long run. The modified framework gives a lower bound on subsidy that is higher than the lower bound in the traditional framework.

The modification matters both in a single period and over a series of periods. In a single period, there is a transfer of subsidized resources implicit in the subsidies received and kept by the DFI. There is an opportunity cost to the DFI for the use of the resources provided by the non-

payment of the full price of subsidized resources. There is a subsidy on the subsidized resources made from a subsidy. If the DFI did not pay a private entity for the use of resources entrusted to it, then the private entity would count the unpaid return as a further investment. A private investor would expect above-average returns later to make up for below-average returns now.

Over a series of periods, the measure of subsidy should include not only the subsidy on subsidized resources from the subsidy received in the current period, but also the subsidy on subsidized resources from subsidies received in previous periods. This follows from the logic of the private investor and the logic of the SDI^T itself.

1.4 Does the difference between measures of subsidy matter?

The difference between the subsidy measured by the traditional and modified frameworks is not the useless sandbox play of alternative-assumptions-thus-alternative-conclusions scorned by McCloskey (1996). In practice, the difference is big. How big? For the Grameen Bank, the difference in 1994 is about $7 million, and the accumulated difference from 1986 to 1994 is about $42 million in 1994 dollars (Table 6). For Caja los Andes, the difference in 1995 is about $550,000, and the accumulated difference over the four years of Andes' life is about $1.1 million in 1995 dollars (Table 12).

This is a lot of money. But it is small change for the organizers of the Global Microcredit Summit in Washington D.C. in Feb. 1997. They made the lofty goal of giving access to financial services to 100 million of the world's poorest people by 2005 with a budget of $21.6 billion (*The Economist*, 1997). In the United States, the bill H.R. 1129 of March 19, 1997 would earmark $170 million in 1998 and $180 million in 1999 for development finance in low-income countries (New York Times, 1997). Development finance is even touted as a way to help U.S. welfare recipients get themselves a job (Wall Street Journal, 1997).

These are wonderful goals. The problem is that the assumption that the benefits are more than the costs is based on a handful of projects. The few DFIs that have been judged as successful have achieved that status because SDI^Ts showed them as either almost financially self-sufficient or just barely financially self-sufficient (Khandker, *et. al.*, 1995; Christen *et al*. 1995, Benjamin, 1994). But if the SDI^T underestimates subsidy and therefore overestimates financial self-sufficiency, then development finance may not be such a good use of scarce development resources after all.

This paper modifies the SDI^T framework. The modified framework capitalizes subsidies just as a private investor would capitalized unrealized returns. Subsidy in the modified framework is a higher lower bound than is subsidy in the traditional framework. This ratchets the performance benchmark of DFIs up a notch.

Subsidy should be measured not only at a point in time but also over time. It would not make sense to judge the benefits and costs of a dam that took five years to build by looking only at the benefits and costs in the sixth year. It also does not make sense to judge the benefits and costs of

development finance by looking only at one period. It is true that past costs are sunk for some analyses so that the relevant measure of subsidy should ignore past subsidies. But usually even these analyses is enriched by looking at subsidies in the long term. "The Parable of the Subsidized Servant" in Appendix 1 shows how the differences between the traditional and the modified frameworks can matter both in a single period and over a series of periods.

The paper is also didactic. There have been many errors and misinterpretations of the SDI^T formula. This paper reformulates the SDI^T in terms of well-defined basic accounts so that the formula itself shows the economic concepts behind it. The reformulation also shows that the SDI^T is invariant to the way the DFI receives resources.

The paper has four more sections. Section 2 is a typology of the ways a DFI can receive subsidized resources. Section 3 recasts Yaron's (1992a) SDI^T in terms of the accounts of a set of stylized financial statements. Section 4 modifies the framework so that it counts the subsidies made by the subsidized resources that are unpaid subsidies. Section 5 gives the traditional and modified measures for the Grameen Bank and for Caja los Andes. It also uses the modified measure in a pseudo-benefit-cost analysis.

2. Typologies of subsidized resources

A DFI can receive subsidized resources explicitly or implicitly. A DFI gets subsidized resources explicitly when it gets things for free. Examples include cash grants or donated assets such as computer equipment or vehicles. Explicit transfers are often recorded in the accounts.

A DFI receives subsidized resources implicitly when it pays a below-market price or when a donor pays for something bought by the DFI. For example, a donor may pay for training of employees of the DFI or for an analysis by a consultant. Or donors may lend funds cheaper than private sources would lend. Likewise, donors may not demand returns on equity investments as a private investors would. Such transactions make subsidized resources by letting the DFI use resources that otherwise it would have paid and lost.

2.1 Subsidized resources are not subsidies

The concept of *subsidized resources* is not the same as the concept of *subsidies*. Subsidized resources are entrusted to the DFI at a below-market prices. Subsidy is the difference between the market price of a subsidized resource and what the DFI pays.

Suppose society entrusts a DFI with the use of \$100 for a year with a loan without interest. Suppose m is the market rate of interest for such a loan to a borrower as risky as the DFI. The subsidized resources gained by the DFI as a result of the loan is the difference between the opportunity cost and what is paid $\$100\cdot(m–c)$. The subsidy from the use of the subsidized resources for a year is not $\$100\cdot(m–c)$ but rather $m\cdot\$100\cdot(m–c)$. The \$100 of loan principal itself is neither a subsidy nor a subsidized resource.

The concept of *subsidized resources* is linked to the concept of *subsidies*. Subsidies from the use of subsidized resources do not go away; they become subsidized resources and make more subsidies. The SDI^T ignores this link.

Suppose a DFI got $\$100 \cdot m$ as a subsidy from a loans of \$100. If the DFI were unsubsidized, it would pay this $\$100 \cdot m$, and it would need to increase its average debt in the period by $\$100 \cdot m/2$ to keep the same level of service as in the subsidized case. It would pay $\$100 \cdot m^2/2$ for this extra debt. The $\$100 \cdot m^2/2$ is also subsidized resources since it is a resource the DFI would not have if it were not subsidized.

2.2 A DFI can receive subsidized resources in six ways

Two of the six ways a DFI can receive subsidized resources are explicit, and four are implicit. The first way a DFI can receive subsidized resources is explicitly as a cash grant accounted for as an equity injection. The subsidy is not the grant itself but rather the return the DFI would pay in the long-run for capital from a private investor. The opportunity cost is the opportunity cost of equity, as it is for all types of subsidized resources.

The second way a DFI can receive subsidized resources is explicitly as a cash grant accounted for as revenue. All grants should be accounted for not as revenue but rather as equity injections. This is because grants are not from the DFI's business operations. Still, DFIs inflate accounting profits by counting grants as revenue. The economic effects of grants accounted for as revenue are the same as the economic effects of grants accounted for as equity injections. Both increase equity. As always, the subsidy is not the grant itself but rather the increase in the usage cost the DFI would incur if the extra equity from the grant had come from private investors.

The third way a DFI can receive subsidized resources is implicitly as discounts on subsidized debt. The discount is the difference between the market price for debt of similar risk from private lenders and the price the DFI paid to donors. The discount is not the subsidy. The subsidy is the opportunity cost of the use of the subsidized resources provided by the discount. The discount reduces expenses, increases profits, increases retained earnings, and so increases equity. Thus the opportunity cost on subsidized resources provided as discounts on subsidized debt is the opportunity cost of equity.

The fourth way a DFI can receive subsidized resources is implicitly as discounts on operating expenses due to a donor's paying for something bought by the DFI. Such purchases are discounts on operating expenses only if the DFI does not record the full price of the purchase as an expense and, in the case of assets, if the DFI fails to record the asset on the balance sheet. If either of these conditions are not met, then the transaction is either unsubsidized or falls into one of the other five ways of receiving subsidized resources. Discounts on operating expense decrease expenses, increase profits, increase retained earnings, and increase the amount of equity belonging to society. The subsidy on the subsidized resources created by discounts on operating expenses is the unpaid opportunity cost on the extra equity. In practice, discounts on operating expenses are varied,

common, and elusive. They leave no trace in the financial statements. Examples of discounts on operating expenses include exemption from reserve requirements or coverage of training costs or organization expenditures.

The fifth way a DFI can receive subsidized resources is implicitly as discounts on capitalized subsidies. Capitalized subsidies are subsidies for which the DFI has not yet reimbursed society. As discussed above, these subsidies make subsidized resources with an opportunity cost.

The sixth way a DFI can receive subsidized resources is implicitly as reinvestments of positive profits. Positive profits belong to owners. If they are not withdrawn, they are implicitly reinvested. Retained earnings have an opportunity cost just like any other form of equity.

The opportunity cost of all six types of subsidized resources is the opportunity cost of subsidized equity. The opportunity cost of subsidized equity is the return a private investor would expect in the long run for an investment of similar risk to the DFI.

Subsidized equity is the resources entrusted by donors to the DFI. Subsidized equity includes grants accounted for as equity, grants accounted for as revenue, capitalized subsidies, and any portion of positive retained earnings due to donors. Subsidized equity also includes discounts on debt and discounts on operating expenses. If the change in retained earnings in any period would have been negative without subsidies, then subsidized equity will be more than total accounting equity. This is the usual case in practice.

Subsidized resources are the same regardless of which of the six ways they are received by the DFI. Likewise, the subsidy linked to subsidized resources does not depend on the form of the subsidized resources. Cash is fungible, implicit cash even more so.

Measured subsidy should not depend on the form of the subsidized resources. If it did, then donors and accountants could give a DFI subsidized resources in ways that implied less subsidy than would other ways that are identical from an economic point of view. If the measured subsidy is not invariant to the form of the subsidized resources, then a DFI could have different estimates of subsidies depending on whether it got $100 as a grant recorded as equity, as a grant $100 recorded as revenue, as a discount on subsidized debt, as $100 of free training, as a discount on capitalized subsidies, or as unwithdrawn positive profits.

The next section recasts Yaron's (1992a) SDI^T framework in terms of the accounts of a set of stylized financial statements. The reformulation uncovers two important facts buried in the traditional formula. First, S^T is invariant to the way the DFI receives subsidized resources if a definition is clarified. Second, the SDI^T correctly excludes subsidized resources and includes only subsidies.

3. A reformulation of the traditional subsidy framework

Probably the most oft-quoted passage in development finance is the definition of the SDI (Yaron, 1992a, p. 17). The definition here follows the passage except in using different opportunity costs for debt and for equity:

$$SDI_{\ominus}^{\Im} = \frac{A_{\ominus} \cdot (m_{\subset \ominus} - c_{\ominus}) + SE_{\ominus} \cdot m_{\supset \ominus} + K_{\ominus} - P_{\ominus}}{LP_{\ominus} \cdot i_{\ominus}}, \qquad (2)$$

where

$m_{\subset \ominus}$ = Opportunity cost to the DFI of debt,
$m_{\supset \ominus}$ = Opportunity cost to DFI of equity,
$A_{\ominus}$ = Average periodic subsidized debt,
$c_{\ominus}$ = Periodic interest rate paid on subsidized debt,
$SE_{\ominus}$ = Average periodic subsidized equity,
$P_{\ominus}$ = Accounting profit,
$LP_{\ominus}$ = Average periodic net loan portfolio, and
$i_{\ominus}$ = Average on-lending interest rate.

K_t is a plug. It cancels with other parts of the formula so as to exclude subsidized resources and to include subsidies. But the original definition of K_t is hazy. Yaron (1992a, p. 17) says K_t is "the sum of all other types of [periodic] subsidies received by the DFI in the period (such as partial or complete coverage of the DFI's operational costs by the state)". This makes it clear that K_t should include discounts on operating expenses and that K_t should exclude both discounts on subsidized equity and discounts on subsidized debt. But it is unclear whether K_t should include grants accounted for as revenue and/or grants accounted for as equity. Yaron (1992a) implies that K_t excludes grants accounted for as revenue by saying "all *other* types of [periodic] subsidies" [italics added] because accounting profit already includes grants accounted for as revenue. To add to the confusion, K_t is called "miscellaneous subsidies" (p. 53). K_t is defined explicitly below.

The idea of the SDI^T is (1), and the implementation of the idea is (2). The two denominators in (1) and in (2) are obviously the same. But the two numerators are not obviously the same. Many users of the SDI^T (*e.g.* Khandker *et al.*, 1995) say that $A_t \cdot (m_{dt} - c_t) + K_t + SE_t \cdot m_{et}$ is the subsidy received in the period. But this is wrong. Only the term $SE_t \cdot m_{et}$ is subsidy. K_t is a plug and it includes, as will be shown, not subsidy but rather some forms of subsidized resources. Likewise, $A_t \cdot (m_{dt} - c_t)$ is not subsidy but rather the discount on subsidized debt. Finally, P_t in (2) is accounting profits, not profits without subsidies as in (1).

3.1 Non-accounting data

Both accounting and non-accounting data are used to estimate subsidy. The non-accounting data are the opportunity cost of subsidized debt, the opportunity cost of subsidized equity, and any discount on operating expenses. The opportunity costs of subsidized debt and of subsidized equity

are counterfactual quantities that must be assumed by the analyst guided by Yaron (1992b) and Benjamin (1994). The DFI or donors must divulge any discounts on operating expenses.

Yaron says the SDI^T estimates financial self-sustainability by taking "full account of the overall social costs entailed in operating a DFI" (1992b, p. iii). The opportunity cost of equity used by the SDI^T is not, however, the opportunity cost of society. Rather, it is the opportunity cost of the DFI. It is not the return society could get on its resources in their best other use but rather the price the DFI would pay for equivalent resources from the market.

In general, the opportunity costs of society and of the DFI are not the same. For example, a weak DFI may not be able to borrow $1,000 from a private lender without paying an annual rate of interest of 100 percent. The opportunity cost to society of $1,000, however, is probably between 10 to 20 percent per year.

Thus, the SDI^T framework does not measure social costs. It does not take the point of view of society. It takes the point of view of the DFI. Which point of view matters depends on the question the analysis intends to inform. It is easy to adjust the framework to account for social costs by basing m_{dt} and m_{et} on the opportunity costs of society. Section 5 has an example.

3.2 Accounting data from the income statement

The non-accounting data are combined with accounting data from the financial statements. Tables 1, 2, 7, and 8, are examples of sets of stylized financial statements for the Grameen Bank and for Caja los Andes. For revenue in the income statement in Tables 1 and 7:

$$Revenue\ operations_{\ominus} = Revenue\ lending_{\ominus} + Revenue\ other\ operations_{\ominus}, \text{ and}$$
$$Total\ revenue_{\ominus} = Revenue\ operations_{\ominus} + Grants\ as\ revenue_{\ominus}.$$

For expenses in the income statement:

$$Total\ expenses_{\ominus} = Acct.\ expense\ subsidized\ debt_{\ominus} + Acct.\ expense\ other\ operations_{\ominus}.$$

The accounts do not record *True expense for subsidized debt*$_t$ nor *Discount for subsidized debt*$_t$. But given that:

$$c_{\ominus} = (Exp.\ sub.\ debt._{\ominus})/A_{\ominus},$$

and taking the periodic average of stocks as the sum of the opening and closing balances divided by 2, then $A_t \cdot (m_{dt} - c_t)$ is the *Discount on subsidized debt*$_t$:

$$\begin{aligned} A_{t}\cdot(m_{t-1}-c_{t}) &= A_{t}\cdot m_{t-1}-A_{t}\cdot c_{t},\\ &= (m_{t-1}/2)\cdot(Sub.\ debt_{t-1}+Sub.\ debt_{t})-A_{t}\cdot(Exp.\ sub.\ debt_{t}/A_{t}),\\ &= True\ exp.\ sub.\ debt_{t}-Exp.\ sub.\ debt_{t},\\ &= Disc.\ sub.\ debt_{t}. \end{aligned} \tag{3}$$

The *True expense for subsidized debt*$_t$ is the sum of the expense in the accounts and the discount on subsidized debt:

$$True\ exp.\ debt_{t} = Exp\ sub.\ debt_{t} + Disc.\ sub.\ debt_{t}. \tag{4}$$

The identity for operating expenses is similar:

$$True\ exp.\ other\ op._{t} = Acct.\ exp.\ other\ op._{t} + Disc.\ other\ op._{t}. \tag{5}$$

Accounting profit is total revenue less total expenses. This can be expressed in terms of operating revenues, true expenses, and transfers of subsidized resources as grants and discounts:

$$\begin{aligned} Acct.\ profit_{t} &= (Total\ rev._{t}-Total\ exp._{t}),\\ &= (Rev.\ op._{t}+Grants\ as\ rev._{t})-\\ &\quad (Acct.\ exp.\ debt_{t}+Acct.\ exp.\ other\ op._{t}),\\ &= (Rev.\ op._{t}+Grants\ as\ rev._{t})-\\ &\quad [(True.\ exp.\ sub.\ debt_{t}-Disc.\ sub.\ debt_{t})+\\ &\quad (True.\ exp.\ other\ op._{t}-Disc.\ other\ op._{t})]. \end{aligned} \tag{6}$$

True profit$_t$ is revenue from operations less true expenses, or what accounting profit would have been without subsidies. *True profit*$_t$ removes grants accounted for as revenue and discounts on expenses from *Accounting profit*$_t$ in (6):

$$\begin{aligned} True\ profit_{t} &= Rev.\ op._{t}-(True.\ exp.\ sub.\ debt_{t}+True.\ exp.\ other\ op._{t}),\\ &= Acct.\ profit_{t}-\\ &\quad (Grants\ as\ rev._{t}+Disc.\ sub.\ debt_{t}+Disc.\ other\ op._{t}). \end{aligned} \tag{7}$$

Retained earnings links the income statement to the balance sheet:

$$\begin{aligned} \Delta R.E._{t} &= Acct.\ profit_{t},\\ &= True\ profit_{t}-(Grants\ as\ rev._{t}+Disc.\ sub.\ debt_{t}+Disc.\ other\ op._{t}). \end{aligned} \tag{8}$$

The *SDI*^{T} assumes no private owners and no dividends. This is relaxed later.

3.3 Accounting data from the balance sheet

In the assets in the balance sheet in Tables 2 and 8:

$$Total\ assets_{t} = Net\ loan\ portfolio_{t} + Other\ assets_{t}.$$

For liabilities:

$$Total\ liabilities_t = Subsidized\ debt_t + Other\ liabilities_t.$$

In each of the three sets of equity accounts, closing equity is the sum of opening equity and the change in equity. The book value of shares bought by private investors with their own money are counted in *Paid-in capital*$_t$. The book value of shares bought by donors are counted in *Grants as equity*$_t$. The sum of the three closing equity accounts is *Total equity*$_t$:

$$\begin{aligned}
Close\ paid\text{-}in\ cap._t &= Open\ paid\text{-}in\ cap._t + \Delta Paid\text{-}in\ cap._t,\\
Close\ cap.\ grants_t &= Open\ cap.\ grants_t + Grants\ as\ equity_t,\\
Close\ R.E._t &= Open\ R.E._t + \Delta R.E._t, \text{ and}\\
Total\ equity_t &= Close\ paid\text{-}in\ cap._t + Close\ cap.\ grants_t +\\
&\quad Close\ R.E._t.
\end{aligned}$$

3.4 The formula for the traditional measure of subsidy in terms of accounts

Given m_{dt} and m_{et} and *Discounts on other operating expenses*$_t$, the SDI^T can be expressed in terms of the accounts from the stylized financial statements. (3) puts the first term in the numerator of (2), $A_t \cdot (m_{dt} - c_t)$, in terms of the accounts.

Expressing $SE_t^T \cdot m_{et}$, the second term in the numerator of equation (2), in terms of accounts uses three facts. First, the average subsidized equity used in the period, SE_t^T, is the average of the TSE_{t-1}^T and TSE_t^T, the subsidized equity outstanding at the opening and at the closing of the period. Second, TSE_t^T is the sum of TSE_{t-1}^T and the change in subsidized equity during the period, ΔTSE_t^T. Third, ΔTSE_t^T is *Grants as equity*$_t$ plus $\Delta R.E._t$:

$$\begin{aligned}
SE_t^{\mathfrak{I}} \cdot m_{\supset t} &= (m_{\supset t}/2) \cdot (TSE_{t-1}^{\mathfrak{I}} + TSE_t^{\mathfrak{I}}),\\
&= (m_{\supset t}/2) \cdot (TSE_{t-1}^{\mathfrak{I}} + TSE_{t-1}^{\mathfrak{I}} + \Delta TSE_t^{\mathfrak{I}}),\\
&= m_{\supset t} \cdot TSE_{t-1}^{\mathfrak{I}} + (m_{\supset t}/2) \cdot (Grants\ as\ equity_t + \Delta R.E._t),\\
&= m_{\supset t} \cdot [\sum_{\varnothing=\cap}^{t-\cap} (Grants\ as\ equity_\varnothing + \Delta R.E._\varnothing)] +\\
&\quad (m_{\supset t}/2) \cdot (Grants\ as\ equity_t + \Delta R.E._t).
\end{aligned} \tag{9}$$

The numerator of (2) is the traditional measure of compensated subsidy CS_t^T. It combines the definition of K_t below with (3), (7), (8), and (9):

$$
\begin{aligned}
CS_{t}^{T} = {} & \textit{Disc. sub. debt}_{t} + \\
& m_{t-1} \cdot \Big[\sum_{s=1}^{t-1} \big(\textit{True profits}_{s} + \textit{Grants as equity}_{s} + \textit{Grants as rev.}_{s} + \\
& \qquad \textit{Disc. sub. debt}_{s} + \textit{Disc. other op.}_{s} \big) \Big] + \\
& (m_{t-1}/2) \cdot \big(\textit{True profits}_{t} + \textit{Grants as equity}_{t} + \textit{Grants as rev.}_{t} + \\
& \qquad \textit{Disc. sub. debt}_{t} + \textit{Disc. other op.}_{t} \big) + \\
& K_{t} - \\
& \big(\textit{True profit}_{t} + \textit{Grants as rev.}_{t} + \textit{Disc. sub. debt}_{t} + \textit{Disc. other op.}_{t} \big).
\end{aligned}
\tag{10}
$$

The first line of (10) is $A_t \cdot (m_{dt} - c_t)$, the second through fifth lines are $SE_t^T \cdot m_{et}$, the sixth line is K_t, and the last line is P_t. (10) is just a reformulation of the traditional compensated subsidy in the numerator of (2). Nothing has been modified yet.

If the measured subsidy is to be invariant to how the DFI receives subsidized resources, then all types of subsidized resources must enter (10) symmetrically. This requires:

$$K_t = \textit{Grants as rev.}_t + \textit{Disc. other op.}_t. \tag{11}$$

This definition of K_t is not in any of the plethora of papers and reports using the SDI^T, although SEEP (1995), the Inter-American Development Bank (1994), and Holtmann and Mommartz (1996) do use this definition implicitly by removing grants accounted for as revenue from their definition of P_t. Most users of Yaron's (1992a) formula either set K_t equal to zero or to *Discounts on other operating expenses*$_t$. If there were grants recorded as revenue in period *t*, then these SDI^Ts are wrong. Many DFIs, especially microfinance NGOs, have some grants accounted for as revenue.

Without the definition of K_t in (11), all the forms of subsidized resources would not enter the subsidy formula symmetrically, so the measured subsidy would depend on arbitrary decisions by donors and/or accountants. This is bad because the economic cost of the use of a unit of subsidized resources are the same regardless of the form of the subsidized resources.

The definition of K_t in (11) makes measured subsidy invariant to how the DFI received subsidized resources. All forms of subsidized resources received before period *t* are multiplied by m_{et}, and all forms of subsidized resources received in period t are multiplied by $(m_{et}/2)$. Combining (11) with (10) gives the reformulation of the traditional compensated subsidy:

$$
\begin{aligned}
CS_{t}^{\mathfrak{I}} &= m_{dt} \cdot \sum_{s=1}^{t-1} (True\ profits_{s} + Four\ new\ sub.\ rsrc._{s}) + \\
&\quad (m_{dt}/2) \cdot (True\ profits_{t} + Four\ new\ sub.\ rsrc._{t}) - \\
&\quad True\ profit_{t}, \\
&= S_{t}^{\mathfrak{I}} - True\ profit_{t}.
\end{aligned}
\tag{12}
$$

The first two lines of (12) are the opportunity cost of the subsidized equity used by DFI in the period. The last line is the amount the DFI could have paid for its subsidized resources if true profits were to be zero. In the traditional framework, a positive compensated subsidy implies financial self-sufficiency.

3.5 Strengths of the reformulation of the traditional measure of subsidy

The reformulation in (12) has at least five strengths compared to the traditional formula in (2). The first strength is to show the invariance of the framework to the way a DFI receives subsidized resources. Grants accounted for as revenue and grants accounted for as equity do not appear explicitly in (2) but rather slither in by their effects on equity. K_t appears in (2) even though it is not subsidy but rather subsidized resources and even though it is not clearly defined. Likewise, $A_t \cdot (m_{dt} - c_t)$ appears in (2) even though it stands not for subsidies but rather for subsidized resources. The reformulation shows that the subsidy is the opportunity cost of subsidized resources multiplied by the subsidized resources used in the period.

The second strength of the reformulation is to show that although the opportunity cost of debt m_{dt} matters for the discount on subsidized debt, the opportunity cost of this discount is m_{et}. It is not obvious in (2) that all forms of subsidized resources have the same opportunity cost.

The third strength of the reformulation is to show that compensated subsidy is the difference between subsidy and profits without subsidy. In contrast to the appearance of (2), subsidy is not $A_t \cdot (m_{dt} - c_t) + SE_t^T \cdot m_{et} + K_t$. Nor are profits without subsidy P_t.

The fourth strength of the reformulation is to show the that there is an opportunity cost on the profits without subsidy earned in period *t* itself. This is not obvious in (2).

The fifth strength of the reformulation is to show how subsidized resources received in previous periods still have an opportunity cost in the current period. This is in the traditional framework, but it is buried.

Section 4 shows and fixes two big mistakes in the traditional framework as embodied in (12). First, the traditional framework wrongly counts negative profits and negative retained earnings as negative subsidized resources. Second, the traditional framework fails to capitalize subsidies. Subsidies should be capitalized because they are implicit injections of equity.

4. The Modified Framework

4.1 Negative true profits are not negative subsidized resources

(12) shows that there is an opportunity cost on *True profits*$_t$ in the period itself. This hints at a problem. If profits in a period are positive, having an opportunity cost makes sense. The owners of the DFI could have claimed these profits as they were earned. Instead, the owners let the DFI keep using them. This is like an injection of equity.

But if profits are negative, then having an opportunity cost does not make sense. Negative profits are not claims by the DFI on owners. Negative profits do not decrease the investment owners had made in the DFI.

Suppose a donor grants \$100 to a new DFI as equity. In the first period, the DFI makes a true profit of -\$100. Even though the DFI would have paid \$100·m_{et} if it did not have subsidized equity, there is no change in subsidized resources by the traditional measure in (12). Thus the traditional measure of subsidy received in the period by the DFI, S_t^T, is zero.

This estimate of S_t^T is wrong. It should be at least \$100·m_{et}. Even the traditional measure of compensated subsidy, CS_t^T, is wrong. CS_t^T is just \$100, but if the DFI bought everything on the market, it would need at least \$100 + \$100·m_{et} more profits just to break even.

If profits are positive, they are subsidized resources. But if profits are negative, they are not negative subsidized resources. To avoid unnecessarily underestimating subsidy and thereby overestimating financial self-sufficiency, *True profits*$_t$ in the subsidy part of (12) should be replaced with Max(0, *True profits*$_t$):

$$S_t = m_{et} \cdot \sum_{s=1}^{t-1} (\textit{True profits}_s + \textit{Four new sub. rsrc.}_s) + (m_{et}/2) \cdot [\text{Max}(0, \textit{True profits}_t) + \textit{Four new sub. rsrc.}_t]. \quad (13)$$

In practice, (13) is not the same as (12) because the usual case is true profits to be negative. But (13) is true to the logic of the traditional framework. This modification means that subsidized equity will be more than total equity if *True profits*$_t$ is negative. This may seem odd, but it makes sense. In the example above, the owners had a claim on the DFI worth \$100 even though total accounting equity was zero. If the DFI were capitalized privately, investors would still expect a periodic return of at least m_{et} in the long run regardless of the level of accounting equity in the short run. This modification increases subsidized equity and so increases the estimate of subsidy and decreases the estimate of financial self-sufficiency.

Without subsidies, retained earnings would be the sum of true profits in previous periods. The sum of true profits in previous periods is the sum of accounting profits in previous periods less accumulated transfers of other subsidized resources, so actual retained earnings are the sum of true profits and accumulated transfers of other subsidized resources.

Positive retained earnings are claims on the DFI by owners. If the owners let the DFI keep using these resources, then retained earnings are an implicit equity injection with an opportunity cost. The logic of the traditional framework suggests that negative retained earnings are not negative subsidized resources. Negative retained earnings are not claims by the DFI on owners and they have no opportunity cost. They do not change the investment owners made in the DFI.

To avoid unnecessarily underestimating subsidy and thereby overestimating financial self-sufficiency, the summation of $True\ profits_i$ in (13) should be replaced with:

$$\mathrm{Max}(0,\ \sum_{\text{all } i} True\ profits_i),$$

giving:

$$S_t' = m_{t-1}\cdot\mathrm{Max}(0,\sum_{\text{all } i} True\ profits_i) + m_{t-1}\cdot\sum_{\text{all } i} Four\ new\ sub.\ rsrc._i + (m_{t-1}/2)\cdot[\mathrm{Max}(0,\ True\ profits_t) + Four\ new\ sub.\ rsrc._t]. \quad (13')$$

If the summation of true profits in the past is negative, then subsidized equity used in the period could be more than total equity even if $True\ profits_t$ is positive.

4.2 There are subsidies on subsidized resources from subsidies in the current period

S_t' in (13') ignores subsidies from subsidized resources made by subsidies in period *t*. If a DFI paid market rates for its resources, it would have to get more market resources to replace those lost in payments, and those resources would make still more costs to be paid.

This means that subsidies S_t' should be on the right side of equation (13'). To keep invariance, S_t' should appear symmetrically with the other subsidized resources received by the DFI in period *t*:

$$S_t' = m_{t-1}\cdot\mathrm{Max}(0,\sum_{\text{all } i} True\ profits_i) + m_{t-1}\cdot\sum_{\text{all } i} Four\ new\ sub.\ rsrc._i + (m_{t-1}/2)\cdot[\mathrm{Max}(0,\ True\ profits_t) + S_t' + Four\ new\ sub.\ rsrc._t].$$

Solving for S_t' gives the modified short-run measure of subsidy, S_t^{MS}:

$$S_t^{MS} = [2/(2-m_{t-1})]\cdot\{m_{t-1}\cdot\mathrm{Max}(0,\sum_{\text{all } i} True\ profits_i) + m_{t-1}\cdot\sum_{\text{all } i} Four\ new\ sub.\ rsrc._i + (m_{t-1}/2)\cdot[\mathrm{Max}(0,\ True\ profits_t) + Four\ new\ sub.\ rsrc._t]\}. \quad (14)$$

The factor $[2/(2 - m_{et})]$ is more than one as long as $m_{et} < 2$. This is the normal case, so subsidy is increased by including subsidized resources made by subsidies in the period. The modified short-run compensated subsidy CS_t^{MS} is S_t^{MS} less $True\ profits_t$. The SDI^T is a short-run measure. Its modified counterpart is SDI_t^{MS}, the ratio of CS_t^{MS} over $Revenue\ from\ lending_t$.

A DFI is financially self-sufficient in the short run if it could have compensated society for the subsidies it received and still had a positive true profit:

$$True\ profits_{t} \geq S_{t}^{MS} . \tag{15}$$

In this case, the SDI_t^{MS} will be non-positive. This implies that, all else unchanged, the DFI could buy all its resources on the market and still break even even if it decreased the average on-lending interest rate. Financial self-sufficiency in the short-run is probably sufficient, but not necessary, for the social benefits of DFI to be more than its social costs from that period on.

The modified measure of subsidy is bigger than the traditional measure for three reasons. First, it does not count negative true profits in the current period as negative subsidized resources. Second, it does not count a negative sum of true profits in previous periods as negative subsidized resources. Third, it does not ignore subsidized resources created by subsidies in the period.

4.3 There are subsidies on subsidized resources from subsidies in past periods

The SDI_t^{MS} pretends that the DFI has repaid society for subsidies received in past periods. Most DFIs do not do this. Past subsidies were equity injections that still have an opportunity cost. If a DFI bought its resources on the market, it would have to pay, in the long-run, a return equal to what those resources could have earned for their owners elsewhere.

A long-run measure of subsidy S_t^{ML} in period t would include the subsidy received in periods 1 ... t-1 on the right side of equation (14), symmetrically with the other subsidized resources received by the DFI in past periods:

$$\begin{aligned} S_{t}^{ML} = {} & [2/(2-m_{t-1})] \cdot \{ m_{t-1} \cdot \mathrm{Max}(0, \sum_{s=1}^{t-1} True\ profits_{s}) + m_{t-1} \cdot \sum_{s=1}^{t-1} (S_{s}^{ML} + Four\ new\ sub.\ rsrc._{s}) \\ & + (m_{t-1}/2) \cdot [\mathrm{Max}(0, True\ profits_{t}) + Four\ new\ sub.\ rsrc._{t}] \} . \end{aligned} \tag{16}$$

Including subsidized resources from subsidies in past periods increases measured subsidy. The modified long-run compensated subsidy CS_t^{ML} is S_t^{ML} less $True\ profits_t$. The ratio of CS_t^{ML} over $Revenue\ from\ lending_t$ is not very useful. It does not make much sense for a DFI to raise interest rates in a single period enough to earn enough to repay past subsidies.

A DFI is financially self-sufficient in the long run if:

$$\sum_{s=1}^{t} True\ profits_{s} \geq \sum_{s=1}^{t} S_{s}^{ML} . \tag{17}$$

In this case, the DFI will have so much retained earnings that it could be liquidated and still pay for its subsidies and give back to society all its subsidized resources. The DFI that is financially self-sufficient in the long run could pay its debt to society.

Long-run financial self-sufficiency is more difficult than short-run financial self-sufficiency. Like short-run financial self-sufficiency, long-run financial self-sufficiency is sufficient, but not necessary, for the social benefits of DFI to be more than its social costs, including costs in the past.

4.4 How to find subsidy with private owners and/or with dividends

Although most DFIs do not have private owners nor do they pay dividends, some of the most important DFIs do. For example, members of the Grameen Bank own most of its shares (Hashemi, 1997).

Dividends paid by a DFI to donors at the end of a period compensate society for the use of its resources. Dividends decrease equity by decreasing retained earnings. The share of dividends paid to society corresponds to society's share of paid-in equity and grants accounted for as equity at the close of the period:

$$\alpha_{\ominus} = \frac{Closing\ \ cap.\ \ grants_{\ominus}}{Closing\ \ cap.\ \ grants_{\ominus} + Closing\ \ paid\text{-}in\ \ cap._{\ominus}}. \tag{18}$$

Dividends are declared at the close of the period. Private owners have a claim on positive profits and on positive retained earnings. The share of positive profits and retained earnings belonging to society is the share of the average resources entrusted to the DFI by donors to the average resources entrusted to the DFI from all sources:

$$\begin{aligned}\rho_{\ominus} = \{&\sum_{\varnothing=\cap}^{\ominus-\cap}(S_{\varnothing}^{\partial\rightarrow} + Four\ new\ sub.\ rsrc._{\varnothing}) + \mathrm{Max}(0,\ \sum_{\varnothing=\cap}^{\ominus-\cap}\rho_{\varnothing}\cdot True\ \ Profit_{\varnothing} - \alpha_{\varnothing}\cdot Div._{\varnothing}) \ +\\ &(1/2)\cdot[S_{\ominus}^{\partial\rightarrow} + Four\ new\ sub.\ rsrc._{\ominus} + \mathrm{Max}(0,\ \rho_{\ominus}\cdot True\ \ Profit_{\ominus})]\}\cdot\\ &1/\{\sum_{\varnothing=\cap}^{\ominus-\cap}(S_{\varnothing}^{\partial\rightarrow} + Four\ new\ sub.\ rsrc._{\varnothing} + \Delta paid\text{-}in\ \ cap._{\varnothing}) \ +\\ &\mathrm{Max}(0,\ \sum_{\varnothing=\cap}^{\ominus-\cap}True\ \ Profit_{\varnothing} - Div._{\varnothing}) \ +\\ &(1/2)\cdot[S_{\ominus}^{\partial\rightarrow} + Four\ new\ sub.\ rsrc._{\ominus} + \Delta paid\text{-}in\ \ cap._{\ominus} + \mathrm{Max}(0,\ True\ \ Profit_{\ominus})]\}.\end{aligned} \tag{19}$$

The modified measure of subsidy with private owners is then:

$$\begin{aligned}S_{\ominus}^{\partial\rightarrow} = [2/(2 - m_{\supset\ominus})]\cdot\{&m_{\supset\ominus}\cdot\mathrm{Max}(0,\sum_{\varnothing=\cap}^{\ominus\cap}\rho_{\varnothing}\cdot True\ \ profits_{\varnothing} - \alpha_{\varnothing}\cdot Div._{\varnothing}) \ +\\ &m_{\supset\ominus}\cdot\sum_{\varnothing=\cap}^{\ominus\cap}(S_{\varnothing}^{\partial\rightarrow} + Four\ \ new\ \ sub.\ \ rsrc._{\varnothing}) \ +\\ &(m_{\supset\ominus}/2)\cdot[\mathrm{Max}(0,\ \rho_{\ominus}\cdot True\ \ profits_{\ominus}) + Four\ \ new\ \ sub.\ \ rsrc._{\ominus}]\}.\end{aligned} \tag{20}$$

The modified measure of compensated subsidy with private owners is:

$$CS_{\ominus}^{\partial\nabla\rightarrow} = S_{\ominus}^{\partial\nabla\rightarrow} - (\rho_{\ominus}\cdot True\ \ profits_{\ominus} - \alpha_{\ominus}\cdot Div._{\ominus}). \tag{21}$$

(19) and (20) are two equations in two unknowns, ρ_t and S_t. If there are no private owners, then Δ*Paid-in capital*$_t$ is zero and ρ_t is unity by definition. Even if there are private owners, if *True profit*$_t$ is negative, then ρ_t vanishes from the right-hand sides of both (19) and (20) and ρ_t is easy to find. This is the usual case. If there are also no dividends, then (20) is (16).

If there are private owners and *True profit*$_t$ is positive, then (19) can be solved for ρ_t in terms of the unknown S_t. Then (20) can be solved numerically for S_t and the solution can be plugged into (19) to get ρ_t for use in future periods:

$$\rho_{\ominus} = \frac{2 \cdot a + S_{\ominus}}{2 \cdot b + S_{\ominus} - \textit{True profit}_{\ominus}},$$

where

$$a = \sum_{\varnothing = \cap}^{\ominus - \cap} (S_{\varnothing}^{\partial \nabla \rightarrow} + \textit{Four new subs. rsrc.}_{\varnothing}) +$$
$$\text{Max}(0, \sum_{\varnothing = \cap}^{\ominus \cap} \rho_{\varnothing} \cdot \textit{True Profit}_{\varnothing} - \alpha_{\varnothing} \cdot \textit{Div.}_{\varnothing}) + (1/2) \cdot (\textit{Four new subs. rsrc.}_{\ominus}), \text{ and}$$

$$b = \sum_{\varnothing = \cap}^{\ominus - \cap} (S_{\varnothing}^{\partial \nabla \rightarrow} + \textit{Four new subs. rsrc.}_{\varnothing} + \Delta \textit{Paid-in cap.}_{\varnothing}) +$$
$$\text{Max}(0, \sum_{\varnothing = \cap}^{\ominus \cap} \textit{True Profit}_{\varnothing} - \textit{Div.}_{\varnothing}) +$$
$$(1/2) \cdot (\textit{Four new subs. rsrc.}_{\ominus} + \Delta \textit{Paid-in cap.}_{\ominus} + \textit{True profit}_{\ominus}).$$

The traditional measures of subsidy in Section 5 below do not adjust for private ownership. This overestimates subsidy but make the numbers comparable to previous calculations (*e.g.*, Khandker, 1995).

4.5 Notes on the use of the modified measures of subsidy

Both of the modified measures are of subsidy are, like the traditional measures, lower bounds. But they are higher lower bounds.

Both of the modified measures of subsidy can inform some questions. For example, managers of a DFI can stop bothering with donors once the DFI is financially self-sufficient in the short-run.

A private investor would selfishly invest in starting a similar organization from scratch only if a DFI is expected to be financially self-sufficient in the long run. A private investor would selfishly invest in an existing DFI only if it is already financially self-sufficient in the short-run.

Donors can use the measures as comparative tools. Both the short-run and the long-run measures can help allocate resources earmarked for development finance. Donors should expect more output in the present from DFIs who used up more inputs in the past.

The measure of subsidy can also be turned into a measure of social cost. The opportunity cost of equity m_{et} could be defined as the opportunity cost of resources from the point of view of the donor with alternative development investments. It could also be seen as the opportunity cost of resources from the point of view of the taxpayers with other uses for their money.

5. Application

This section measures subsidy with the traditional and modified frameworks for the Grameen Bank of Bangladesh and for Caja los Andes, a microfinance NGO in Bolivia. The traditional and modified estimates differ a lot. The two DFIs are much less financially self-sufficient than was thought.

This section also uses the modified subsidy from the point of view of society in a donor leverage ratio, in a donor output ratio, and in a pseudo-benefit-cost analysis. Both DFIs probably have social benefits that are more than their social costs.

5.1 The donor leverage ratio

Rosenberg (1994) conceived the idea of donor leverage. He reasoned that if development finance for the poor can be financially self-sufficient and if donors do not have enough funds to saturate the market, then donors should focus on leveraging private funds.

To be useful, donor leverage must be measured. Schreiner and González-Vega (1995) and Rosenberg *et al*. (1997) used the ratio of the average non-subsidized resources used in a period over the average subsidized resources used in a period. If S_t^{MLS} is the modified measure of subsidy in the long run from the point of view of society, then the DLR_t is:

$$DLR_{\ominus} = \frac{Ave.\ non\text{-}subsidized\ resources_{\ominus}}{Ave.\ subsidized\ resources_{\ominus}},$$

where

$$Ave.\ non\ sub.\ rsrc_{\ominus} = \sum_{\varnothing=\cap}^{\ominus-\cap} Paid\text{-}in\ cap._{\varnothing} + \mathrm{Max}[0,\ \sum_{\varnothing=\cap}^{\ominus\cap} (1-\rho_{\varnothing})\cdot True\ Profit_{\varnothing} - (1-\alpha_{\varnothing})\cdot Div._{\varnothing}] +$$
$$(1/2)\cdot\{Dep.\ by\ poor_{\ominus\cap} + Dep.\ by\ poor_{\ominus} +$$
$$Other\ libs._{\ominus\cap} + Other\ libs._{\ominus} + \Delta Paid\text{-}in\ cap._{\ominus} +$$
$$\mathrm{Max}[0,\ (1-\rho_{\ominus})\cdot True\ Profit_{\ominus}]\},\ \text{and}$$

$$Ave.\ sub.\ rsrc_{\ominus} = \sum_{\varnothing=\cap}^{\ominus-\cap} (4\ new\ sub.\ rsrc._{\varnothing} + S_{\varnothing}^{\partial\nabla\hbar}) + \mathrm{Max}[0,\ \sum_{\varnothing=\cap}^{\ominus\cap} (\rho_{\varnothing}\cdot True\ Profit_{\varnothing} - \alpha_{\varnothing}\cdot Div._{\varnothing})] +$$
$$(1/2)\cdot[Sub.\ debt_{\ominus\cap} + Sub.\ debt_{\ominus} + S_{\ominus}^{\partial\nabla\hbar} + 4\ new\ sub.\ rsrc._{\ominus} +$$
$$\mathrm{Max}(0,\ \rho_{\ominus}\cdot True\ Profit_{\ominus})].$$

The DLR_t shows how the performance of the DFI has enabled and motivated the use of market resources. If the goal of society is to saturate the market, the donors should act so as to maximize the DLR_t. But the goal of society is not to saturate the market; the goal of society is to maximize social welfare. Maximizing the DLR_t is good only inasmuch as attracting private funds to development finance helps maximize social welfare. Attracting private funds is good if it increases the number and the volume of voluntary transactions between DFIs and clients. More voluntary transactions are good because, at least in expectation and at least for those choosing to transact, the benefits of voluntary transactions are always more than the costs. The benefits of involuntary, non-market transactions are not always more than the costs, even in expectation, which is why subsidy must be measured in the first place.

The idea of a DLR_t has at least two weaknesses. First, the DLR_t looks only at resources entrusted to DFIs by donors. Second, the DLR_t ignores both the benefits of the resources and the costs of the resources.

5.2 The donor output ratio

Benefits are the difference in the utility of the clients with and without the DFI. While benefits are undoubtedly more than costs, measuring benefits is costly (Von Pischke and Adams, 1980; David and Meyer, 1980). Still, on average, the monetary value of the benefits is a multiple of the average debt in the hands of clients in a period. Average debt is cheap to measure.

The donor output ratio compares social costs to a fraction of social benefits. The DOR_t is the ratio of LP_t, the average net loan portfolio, over S_t^{ML}, the cost to society of the resources it entrusted to the DFI:

$$DOR_{\ominus} = LP_{\ominus} / S_{\ominus}^{\partial\nabla}.$$

The DOR_t is a multiple of a benefit-cost ratio without discounting. It measures how much debt for the target group is sparked by a unit of donor resources. A higher DOR_t means more bang for the

buck, but it does not tell exactly how much more. The period could be of any length, including the life of the DFI, but the monetary figures must be in units of a constant currency.

The reciprocal of the DOR_t is the cost to society per dollar-year of debt held by the poor. In the long run, it shows the efficiency of the DFI in using society's resources to increase the welfare of the target group.

5.3 Pseudo-benefit-cost analysis

The idea of pseudo-benefit-cost analysis recognizes that the goal of development finance is to maximize the difference between social benefits and social costs. Pseudo-benefit-cost analysis also recognizes that it is cheap to measure social costs but costly to measure social benefits. The benefits of a full-blown benefit-cost analysis probably are more than the costs, but the benefits of a pseudo-benefit-cost analysis probably are less than the costs.

Subsidies are a lower bound on social costs. On average, benefits are an unknown multiple *b* of the average debt held by the poor. The average debtor gets an average surplus worth *b* for each dollar-year of debt from a DFI.

Pseudo-benefit-cost analysis looks at what *b* would have to be to make the discounted value of benefits more than the discounted value of costs. Weights could be used since benefits accrue to poor people in low-income countries but costs accrue to rich people in high-income countries. Given the modified long-run subsidy in each period from the point of view of society and the average loan portfolio in units of a constant currency, if w_r and w_p are the weights for the rich and the poor and δ is the discount rate, then:

$$b = \frac{\sum_{t=0}^{T} \delta^t \cdot w_p \cdot S_t^{ML}}{\sum_{t=0}^{T} \delta^t \cdot w_r \cdot LP_t}.$$

If *b* is small, then subsidizing the DFI probably has increased social welfare. A benefit-cost analysis at time 0 with the knowledge at time *T* would probably have found that the DFI was a worthwhile investment of scarce resources from the point of view of society.

How small is small needs human discussion. Discussion and sensitivity analysis are also needed to pick good values for the weights and the discount rate. Since S_t^{ML} is a lower bound on costs, *b* is a lower bound on required surplus.

For some DFIs, there are estimates of the marginal product of capital for borrowers with the Grameen Bank. The lower bound on required surplus *b* can be compared to the difference between these estimates and the effective interest rates plus transactions costs for the borrower (Schreiner, 1997). In addition, *b* can be compared to the difference between the cost of debt from a DFI and the cost of similar debt from other sources. This difference is a lower bound on the debtor's surplus.

Usually, however, people will just have to judge whether *b* is so small that the debtor's surplus is likely to be more.

5.4 Application to the Grameen Bank of Bangladesh

The Grameen Bank of Bangladesh has spawned much fervor for development finance. Began as a pilot project in 1976, Grameen was chartered as a bank in 1983. By 1995, it had branches in about 35,500 villages, more than half the villages in Bangladesh. It has more than 2 million borrowers, more than 90 percent of whom are women (Hashemi, 1997). Grameen holds savings for its members, and members own most of the bank's shares. Assets at the end of 1994 were about $400 million.

Grameen disburses loans through groups of borrowers without collateral. Financial services are coupled with teaching economic and social discipline (Khandker *et al.*, 1995). Most members own less than half a hectare of land and have assets worth less than the value of one hectare. The members are poor by any standard, but they are not the poorest of the poor in Bangladesh. The poorest of the poor would burdened by debt, not benefitted (Hashemi, 1997).

Many studies have estimated the SDI of Grameen (*e.g.*, Hashemi, 1997; Morduch, 1997; Khandker *et al.*, 1995; Christen *et al.*, 1995; Benjamin, 1994; Yaron, 1994 and 1992a;). Even Hossain (1988) estimated subsidy. The estimates here span from 1983 to 1994 and use the modified framework. Technical notes are in Appendix 2.

Table 1 shows that true profit has been negative every year even though accounting profit has been negative only twice. Table 2 shows that about two-thirds of Grameen's funds were subsidized by 1994. Table 3 shows that, ignoring 1983, the traditional SDI fell from a high of 168 percent in 1989 to 20 percent in 1994. Grameen had an average on-lending interest rate between 12 and 19 percent over this period, ending at 17 percent in 1994. The rate required for a traditional SDI of zero ranged from 19 percent to 35 percent, ending at 20 percent in 1994.

With the traditional SDI, the Grameen Bank looks efficient. An annual interest rate of 20 percent is low given the costs of making small loans to poor people. The rate charged is only 3 percentage points from the subsidy-free rate.

The modified short-run SDI in Table 4 is bigger because it does not ignore the fact that subsidies received in the current period make subsidized resources and so more subsidies in the current period. The SDI^{MS} falls from a high of 201 percent in 1990 to 27 percent in 1994. Grameen would have to increase its interest rate from 17 percent to 21 percent in 1994. Still, this is not a big jump, and 21 percent is still low for a lender to the poor.

The modified long-run measure of subsidy in Table 4 is even bigger than the modified short-run measure of subsidy because it does not ignore the fact that subsidies received in previous periods make subsidized resources and so more subsidies in the current period. In 1994, the difference between S^{ML} and S^{MS} was about taka 128 million. With an exchange rate of about 40 taka per dollar,

this is about $3.2 million. The assumed opportunity cost took a nose dive from 13 percent to 6 percent between 1993 and 1994 (Table 13), so the difference in 1993 is bigger at about taka 182 million, or about $4.5 million.

The modified measures of subsidy from the point of view of society are in Table 5. They differ from the measures from the point of view of the DFI in that the opportunity cost of both debt and equity was assumed to be 10 percent in each period (Table 13). Thus the subsidy from the point of view of society is smaller than the subsidy from the point of view of the DFI in all years except 1994. Subsidizing Grameen in 1994 cost society about taka 817 million, or about $20 million. In 1993, it cost about taka 939 million, or about $23.5 million.

Table 6 summarizes the subsidy measures in units of millions of dollars as of Dec. 31, 1994. From the point of view of the DFI, the traditional subsidy was about $9 million in 1993 and about $5 million in 1994. The modified short-run subsidy was bigger at about $16 million in 1993 and $8 million in 1994. The modified long-run subsidy was even bigger at abut $20 million in 1993 and about $12 million in 1994.

Summing the modified long-run measure over time shows that Grameen would have had to pay at least $70 million more between 1983 and 1994 to keep the same level of service without subsidized resources. This is $42 million more than the traditional estimate.

Table 6 shows that it cost society at least $58 million to subsidize Grameen from 1983 to 1994. Was it worth it? The DLR, DOR, and pseudo-benefit-cost analysis in Table 6 address this.

The long-run DLR of 0.39 in 1994 means that Grameen used one dollar-year of market resources for every 2.5 dollar-years of subsidized resources entrusted to it by society. Even though the DLR has been falling, its level is not too good. Grameen does not use many market resources. It has not leveraged the $0.99 billion dollar-years of resources entrusted to it much.

The long-run DOR of 2.0 in 1994 means that Grameen put one dollar-year of debt in the hands of poor people for each 50 cents of cost to society. This seems like a lot, and the DOR worsened until 1994 as the portfolio, starting with 58,000 borrowers in 1983 (Hashemi, 1997), grew slower than subsidy, assumed to start at zero. The estimated social cost of 50 cents per dollar-year of debt does not include the interest costs paid by borrowers nor the transactions costs they bear. It is a matter for debate whether Grameen borrowers could benefit from debt even if they paid society for its costs, and thus whether subsidizing Grameen has been worthwhile.

Pseudo-benefit-cost analysis can inform the debate. Looking from the point of view of society in 1983 at the results through 1994, the discounted benefits to borrowers would have been more than the discounted costs to society if the average surplus of the average borrower per dollar-year of debt (*b*) was more than about 7 cents (Table 6). This is not much, although *b* increased until 1994 for the same reasons the DOR increased.

This estimate of *b* is somewhat sensitive to the assumed discount rate and opportunity cost. For example, if the discount rate is left at 5 percent but the opportunity cost of society is changed to 20 percent, then *b* is 19 percent. If the discount rate is set to zero with the opportunity cost set to 10 percent, then *b* is also 19 percent. If both the discount rate and the opportunity cost are 3 percent, then *b* is 2 percent.

Grameen is not financially self-sufficient, neither in the short run nor in the long run. True profits are negative in all periods, and subsidies are always positive. Accumulated true profits are about -$58 million in constant 1994 dollars, whereas accumulated subsidy from the point of view of society is, coincidentally, about $58 million. Grameen is not yet financially self-sufficient in the short run, and it probably will never be financially self-sufficient in the long run.

Yet Grameen may have been worthwhile. So there is both bad news and good news. The bad news is that Grameen does not yet get much of its funding from the market and that Grameen would have been a bad investment for a venture capitalist in 1983. The good news is that Grameen probably has increased social welfare. With slightly higher interest rates, Grameen could attract private investors beyond its own members.

5.5 Application to Caja los Andes, a microfinance NGO in Bolivia

Caja los Andes was founded in Bolivia as a microfinance NGO in 1992. Andes was called Pro-Crédito until 1995, the year it got a charter that subjected it to prudential regulation and that let it mobilize deposits. By the end of 1995, Andes had 8 branches with about 14,000 borrowers, about 60 percent of whom were women. Assets were about $6.6 million (González-Vega *et al*., 1997b).

Andes disburses loans to individuals with collateral. Andes does not offer non-financial services. Borrowers of Andes are poor, but they are not the poorest of the poor in Bolivia. Three-fourths of borrowers from Andes in La Paz are in the top two quintiles of an index of basic-needs achievement (Navajas *et al*., 1996). Andes competes with BancoSol, a bigger, more famous DFI that lends through groups (González-Vega *et al*., 1997a).

González-Vega *et al*. (1997b) estimated the traditional SDI for Andes. Technical notes are in Appendix 3.

Table 7 shows that true profit has been always been negative even though accounting profit has always been positive. Table 8 shows that about 95 percent of Andes' liabilities and equity were subsidized by 1995. Table 9 shows that the traditional SDI had fallen from 211 percent in 1992 to 93 percent in 1995. The average on-lending interest rate also fell over this period, from 47 percent to 23 percent. The rate required for a traditional SDI of zero fell from 148 percent to 43 percent. To double the interest rate in 1995 is less severe than it sounds because the base to be doubled is only about 20 percentage points.

Andes would look financially self-sufficient in the traditional framework if it charged the same interest rate in 1995 that it charged in 1992. This suggests that Andes has a positive SDI^T not because of inefficiency but because of its interest-rate policy.

The modified short-run measure of subsidy in Table 10 is bigger because it does not ignore subsidized resources made by subsidies in the current period. The SDI^{MS} falls from 236 percent in 1992 to 125 percent in 1995.

The modified long-run measure of subsidy in Table 10 is even bigger than the modified short-run measure because it does not ignore subsidized resources made by subsidies received in past periods. In 1995, the difference was about Bs 1 million. With an exchange rate of about 5 bolivianos per dollar, this is about $200,000.

The modified measures of subsidy from the point of view of society are in Table 11. They differ from the measures from the point of view of the DFI in that the opportunity cost of both debt and equity was assumed to be 10 percent in each period (Table 14). Thus the subsidy from the point of view of society is smaller than the subsidy from the point of view of the DFI in all years. Subsidizing Andes cost society about Bs 1.8 million in 1995, or about $360,000.

Table 12 summarizes the subsidy measures in units of millions of dollars as of Dec. 31, 1995. From the point of view of the DFI, the traditional subsidy was about $356,000 in 1995. The modified short-run subsidy was bigger at about $692,000, and the modified long-run subsidy was even bigger at about $909,000.

Summing the modified long-run measure over time shows that Andes would have had to pay at least $2 million more between 1992 and 1995 if it had kept the same level of service without subsidized resources. This is about $1 million more than the traditional estimate.

From the point of view of society, it cost at least $890,000 to subsidize Andes from 1992 to 1995 (Table 12). The DLR, DOR, and pseudo-benefit-cost analysis in Table 12 address whether this cost was worthwhile.

The long-run DLR of 0.06 in 1995 means that Grameen used one dollar-year of market resources for each 17 dollar-years of subsidized resources entrusted to it by society. This is not very good. By 1995, Andes has not leveraged funds from the market with the $11.3 million dollar-years of resources entrusted to it.

The long-run DOR of 2.9 in 1995 means that Andes put one dollar-year of debt in the hands of poor people for every 34 cents of cost to society. Unlike Grameen, Andes has grown the loan portfolio faster than subsidies, so the DOR is increasing. The estimated social cost of 34 cents per dollar-year of debt does not include the interest costs paid by borrowers nor the transactions costs they bear.

Pseudo-benefit-cost analysis can inform the debate about whether subsidizing Andes has been worthwhile. From the point of view of society in 1992 with knowledge of the results through 1995, the discounted benefits to borrowers would have been more than the discounted costs to society if the average surplus of the average borrower per dollar-year of debt (*b*) was more than about 10 cents (Table 12). This is not very much, and *b* is falling.

This estimate of *b* is somewhat sensitive to the assumed discount rate and opportunity cost. For example, if the discount rate is left at 5 percent but the opportunity cost of society is changed to 20 percent, then *b* is 24 percent. If the discount rate is set to zero with the opportunity cost set to 10 percent, then *b* is 10 percent. If both the discount rate and the opportunity cost are 3 percent, then *b* is 3 percent.

Andes is not financially self-sufficient, neither in the short run nor in the long run. True profits are negative in all periods, and subsidies are always positive. Accumulated true profits are about -$1.9 million in constant 1995 dollars, whereas accumulated subsidy from the point of view of society is about $0.9 million.

Still, Andes may have been worthwhile. Subsidizing Andes probably has increased social welfare even though Andes gets little funds from the market and even though Andes would not have been a good investment in 1992. Andes could attract private investors if it increase its interest rates.

5.6 Concluding thoughts

The examples show that there can be a big difference between the subsidy under the traditional and modified framework. There is no reason, other than tradition, not to use the modified framework. Both frameworks use the same data, and both are easy to compute. The spreadsheets used here are available on request.

The modified long-run measure does use historical data, but it is still a higher lower bound than the traditional measure even if past data is not at hand. Even the short-term modified measure is a higher lower bound than the traditional measure. The real work in both frameworks is in judging opportunity costs, ferreting out discounts on operating expenses, and analyzing the results. The modified framework could be used not only for DFIs but also for any subsidized organization that wants to escape from dependence on donors.

The expenses of a subsidized DFI are not the same as the costs the DFI would pay if it had to survive in the market. The difference between these costs and expenses is subsidy. The modified framework measures costs better because it measures subsidies better.

There can be is a big difference between the traditional and the modified measures. For the Grameen Bank of Bangladesh, the difference is of the order of $42 million, 150 percent the size of the traditional measure.

Two the best DFIs are much worse than was thought because their costs are higher than was thought. This is true both from the point of view of the DFI and from the point of view of society. But pseudo-benefit-cost analysis suggests that at least two of the best DFIs have probably improved social welfare.

A DFI can be socially worthwhile even if it is not financially self-sufficient. But short-run financial self-sufficiency is still needed to attract private capital to expand existing DFIs. Long-run financial self-sufficiency is needed to attract private capital to start DFIs from scratch so as to expand development finance to more than a fraction of the poor in the world.

Table 1: Stylized income statement for Grameen

Organization	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Rev. lending	0	23	35	44	65	113	162	221	337	522	1,056	1,646
Rev. other op.	1	13	31	46	61	53	77	117	143	188	183	296
Rev. op.	1	36	66	90	126	166	239	338	480	710	1,238	1,942
Grants as rev.	0	0	0	0	3	34	60	76	73	62	87	76
Total rev.	1	36	66	90	129	200	299	414	553	772	1,325	2,019
True exp. sub. debt	6	22	31	51	122	159	222	265	270	295	587	617
(Discount sub. debt)	(5)	(8)	(5)	(28)	(99)	(131)	(183)	(217)	(219)	(206)	(351)	(95)
Exp. sub. debt	1	14	26	24	22	28	39	48	50	89	235	523
True exp. other op.	3	17	40	66	106	171	257	356	490	689	1,080	1,474
(Discount other op.)	0	0	0	0	0	0	0	0	0	0	0	0
Exp. other op.	3	17	40	66	106	171	257	356	490	689	1,080	1,474
Total exp.	4	31	65	90	128	198	296	404	540	778	1,316	1,997
Acct. profit	(3)	5	1	0	0	1	3	10	13	(6)	9	22
(Dividends)	0	0	0	0	0	0	0	0	0	0	0	0
Change R.E.	(3)	5	1	0	0	1	3	10	13	(6)	9	22
Memo: Rev. op.	1	36	66	90	126	166	239	338	480	710	1,238	1,942
Memo: (True exp. sub. debt)	(6)	(22)	(31)	(51)	(122)	(159)	(222)	(265)	(270)	(295)	(587)	(617)
Memo: (True exp. other op.)	(3)	(17)	(40)	(66)	(106)	(171)	(257)	(356)	(490)	(689)	(1,080)	(1,474)
Memo: True profit	(8)	(3)	(5)	(27)	(102)	(164)	(239)	(283)	(280)	(274)	(429)	(150)

Source: Hashemi (1997) and Khandker *et al*. (1995). Figures in millions of nominal taka.

Table 2: Stylized balance sheet for Grameen

Organization	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Assets												
Net loan portfolio	74	178	246	331	634	1,095	1,593	2,117	2,551	4,424	8,764	11,054
Other assets	45	199	300	572	646	816	1,317	1,846	2,290	2,460	3,513	5,091
Total assets	119	377	546	903	1,279	1,911	2,911	3,964	4,841	6,884	12,277	16,145
Liabilities												
Sub. debt	85	311	434	717	955	1,233	1,720	1,887	1,876	1,878	5,470	8,216
Dep. by poor	19	38	80	117	190	293	445	643	835	1,199	1,955	2,808
Other libs.	0	0	0	25	85	178	360	462	729	1,252	1,824	1,534
Total libs.	104	350	514	859	1,230	1,704	2,525	2,991	3,440	4,329	9,249	12,557
Equity												
Open. paid-in cap.	0	18	25	30	35	42	57	72	72	114	149	150
Change paid-in cap.	18	7	5	5	7	15	15	0	42	35	1	67
Close. paid-in cap.	18	25	30	35	42	57	72	72	114	149	150	217
Open. cap. grants	0	0	(1)	(2)	3	1	142	300	874	1,247	2,359	2,793
Grants as equity	0	(1)	(1)	5	(2)	141	158	574	374	1,111	435	458
Close. cap. grants	0	(1)	(2)	3	1	142	300	874	1,247	2,359	2,793	3,252
Open. R.E.	0	(3)	3	4	5	6	8	13	26	39	47	84
Change R.E.	(3)	6	1	1	1	2	5	13	13	8	37	36
Close R.E.	(3)	3	4	5	6	8	13	26	39	47	84	120
Total equity	15	27	32	44	49	207	385	972	1,401	2,555	3,028	3,588
Total libs. and equity	119	377	546	903	1,279	1,911	2,911	3,964	4,841	6,884	12,277	16,145
Memo: Ave. dep. by poor	9	28	59	98	153	242	369	544	739	1,017	1,577	2,381
Memo: Ave. sub. libs.	43	156	217	358	821	1,083	1,728	2,521	3,245	4,243	6,245	8,176
Memo: Ave. net loan port.	37	126	212	288	482	864	1,344	1,855	2,334	3,529	6,561	9,969

Source: Hashemi (1997) and Khandker *et al*. (1995). Figures in millions of nominal taka.

Table 3: Trad. SDI for Grameen for DFI

Organization	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Grants as rev.	0	0	0	0	3	34	60	76	73	62	87	76
Grants as equity	0	(1)	(1)	5	(2)	141	158	574	374	1,111	435	458
Disc. sub. debt	5	8	5	28	99	131	183	217	219	206	351	95
Disc. other op.	0	0	0	0	0	0	0	0	0	0	0	0
4 forms new sub. rsrc.	5	7	5	33	100	306	400	867	666	1,379	873	629
Open. accum. new sub.	0	5	12	16	49	149	456	856	1,723	2,389	3,768	4,642
True profit	(8)	(3)	(5)	(27)	(102)	(164)	(239)	(283)	(280)	(274)	(429)	(150)
Open. accum. true profit	0	(8)	(11)	(16)	(43)	(145)	(309)	(548)	(831)	(1,111)	(1,385)	(1,814)
Trad. subsidy	(0)	(0)	0	0	1	11	32	84	149	238	339	184
Trad. comp. subsidy	8	3	5	28	103	175	272	367	429	512	768	334
Trad SDI	3982%	12%	14%	63%	158%	155%	168%	166%	127%	98%	73%	20%
On-lending I.R.	1%	19%	17%	15%	13%	13%	12%	12%	14%	15%	16%	17%
Subsidy-free on-lending I.R.	22%	21%	19%	25%	35%	33%	32%	32%	33%	29%	28%	20%

Figures in millions of nominal taka.

Table 4: Mod. SDI for Grameen for DFI

Organization	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen	Grameen
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Grants as rev.	0	0	0	0	3	34	60	76	73	62	87	76
Grants as equity	0	(1)	(1)	5	(2)	141	158	574	374	1,111	435	458
Disc. sub. debt	5	8	5	28	99	131	183	217	219	206	351	95
Disc. other op.	0	0	0	0	0	0	0	0	0	0	0	0
4 new sub. rsrc.	5	7	5	33	100	306	400	867	666	1,379	873	629
Open. accum. new sub.	0	5	12	16	49	149	456	856	1,723	2,389	3,768	4,642
True profit	(8)	(3)	(5)	(27)	(102)	(164)	(239)	(283)	(280)	(274)	(429)	(150)
Open. accum. true profit	0	(8)	(11)	(16)	(43)	(145)	(309)	(548)	(831)	(1,111)	(1,385)	(1,814)
Dividends	0	0	0	0	0	0	0	0	0	0	0	0
Alpha	0.006	(0.054)	(0.071)	0.079	0.023	0.714	0.807	0.924	0.916	0.940	0.949	0.938
Rho short-run	0.233	0.305	0.380	0.545	0.749	0.876	0.923	0.956	0.965	0.968	0.974	0.974
Rho long-run	0.233	0.305	0.382	0.549	0.752	0.877	0.925	0.957	0.966	0.969	0.975	0.975
Open. accum. short-run sub.	0	0	2	4	9	24	71	171	365	669	1,097	1,682
Mod. short-run sub.	0	1	2	5	15	46	101	194	304	428	585	307
Mod. short-run comp. sub.	2	2	4	20	92	190	322	464	574	693	1,003	452
Mod. short-run SDI	1149%	9%	11%	45%	141%	169%	199%	210%	170%	133%	95%	27%
On-lending I.R.	1%	19%	17%	15%	13%	13%	12%	12%	14%	15%	16%	17%
Subsidy-free on-lending I.R.	7%	20%	18%	22%	32%	35%	36%	37%	39%	34%	31%	21%
Open accum. long-run sub.	0	0	2	4	10	27	77	190	412	777	1,313	2,080
Mod. long-run sub.	0	1	2	6	17	51	112	223	364	536	767	435
Mod. long-run comp. sub.	2	2	4	21	93	194	334	493	635	801	1,186	581

Figures in millions of nominal taka.

Table 5: Mod. subsidy for Grameen for society

Organization	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Rho short-run	0.229	0.297	0.367	0.532	0.740	0.871	0.920	0.953	0.963	0.966	0.972	0.972
Rho long-run	0.229	0.298	0.369	0.534	0.742	0.872	0.920	0.954	0.963	0.966	0.973	0.973
Open. accum. short-run sub.	0	0	1	3	6	17	48	117	253	470	794	1,236
Mod. short-run sub.	0	1	1	3	10	32	69	136	216	324	443	522
Mod. short-run comp. sub.	2	2	3	18	86	175	289	405	486	588	860	667
Open accum. long-run sub.	0	0	1	3	7	18	51	126	275	520	899	1,436
Mod. long-run sub.	0	1	2	4	11	34	74	149	245	379	537	673
Mod. long-run comp. sub.	2	2	3	18	87	177	295	419	515	643	955	819

Figures in millions of nominal taka.

Table 6: Subsidy, DLR, DOR, and pseudo-benefit-cost analysis for Grameen

Organization	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
$-years debt in period	2	6	10	12	18	30	43	55	65	94	175	266
Accum. $-years debt	2	8	18	30	48	78	122	177	242	336	511	776
Point of view of DFI												
Trad. subsidy	(0)	(0)	0	0	0	0	1	3	4	6	9	5
Mod. short-run sub.	0	0	0	0	1	2	3	6	8	11	16	8
Mod. long-run sub.	0	0	0	0	1	2	4	7	10	14	20	12
Accum. trad. sub.	(0)	(0)	(0)	0	0	0	1	4	8	14	23	28
Acc. mod. short-run sub.	0	0	0	0	1	3	6	12	20	31	47	55
Acc. mod. long-run sub.	0	0	0	0	1	3	6	13	23	38	58	70
Point of view of society												
Mod. short-run sub.	0	0	0	0	0	1	2	4	6	9	12	14
Mod. long-run sub.	0	0	0	0	0	1	2	4	7	10	14	18
Acc. mod. long-run sub.	0	0	0	0	1	2	4	9	16	26	40	58
Short-run DLR	0.76	0.58	0.70	0.66	0.47	0.48	0.44	0.37	0.35	0.36	0.38	0.39
Long-run DLR	0.76	0.62	0.66	0.66	0.57	0.53	0.49	0.44	0.41	0.39	0.39	0.39
Short-run DOR	0.7	25.6	21.8	11.7	5.8	3.3	2.2	1.5	1.4	1.4	2.0	2.4
Long-run DOR	0.7	19.6	20.8	15.9	9.9	5.8	3.8	2.6	2.1	1.8	1.9	2.0
PV dollar-years debt	2	6	8	10	14	22	30	37	41	56	99	144
PV social costs	0	0	0	0	0	1	2	3	4	6	8	10
Accum. PV dollar-years debt	2	7	16	25	40	62	92	129	170	226	326	469
Accum. PV social costs	0	0	0	0	1	1	3	6	10	16	25	34
Req. ave. debtor surplus (b)	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.07

Figures in millions of dollars as of Dec. 31, 1994.

Table7: Stylized income statement for Andes

Organization	**Pro-Credito**	**Pro-Credito**	**Pro-Credito**	**Andes**
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Rev. lending	671	1,634	3,926	4,904
Rev. other op.	51	54	113	251
Rev. op.	722	1,688	4,040	5,155
Grants as rev.	0	0	0	0
Total rev.	722	1,688	4,040	5,155
True exp. sub. debt	0	315	1,165	2,839
(Discount sub. debt)	(1)	(298)	(1,087)	(1,685)
Exp. sub. debt	1	17	78	1,153
True exp. other op.	1,769	3,231	4,825	5,219
(Discount other op.)	(1,387)	(1,907)	(1,476)	(1,416)
Exp. other op.	382	1,324	3,349	3,804
Total exp.	383	1,340	3,427	4,957
Acct. profit	339	348	613	198
(Dividends)	0	0	0	0
Change R.E.	339	348	613	198
Memo: Rev. op.	722	1,688	4,040	5,155
Memo: (True exp. sub. debt)	0	(315)	(1,165)	(2,839)
Memo: (True exp. other op.)	(1,769)	(3,231)	(4,825)	(5,219)
Memo: True profit	(1,047)	(1,858)	(1,950)	(2,903)

Source: Financial statements of Pro-Crédito and Caja los Andes. Figures in thousands of nominal bolivianos.

Table 8: Stylized balance sheet for Andes

Organization	Pro-Credito	Pro-Credito	Pro-Credito	Andes
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Assets				
Net loan portfolio	2,828	6,368	13,804	29,707
Other assets	735	2,169	2,711	3,280
Total assets	3,564	8,537	16,515	32,987
Liabilities				
Sub. debt	0	3,077	8,981	19,909
Dep. by poor	0	0	0	0
Other libs.	18	330	1,210	2,612
Total libs.	18	3,407	10,191	22,522
Equity				
Open. paid-in cap.	0	0	0	0
Change paid-in cap.	0	0	0	0
Close. paid-in cap.	0	0	0	0
Open. cap. grants	0	3,207	4,442	5,023
Grants as equity	3,207	1,235	581	3,944
Close. cap. grants	3,207	4,442	5,023	8,967
Open. R.E.	0	339	686	1,299
Change R.E.	339	348	613	198
Close R.E.	339	686	1,299	1,497
Total equity	3,546	5,129	6,322	10,464
Total libs. and equity	3,564	8,536	16,513	32,986
Memo: Ave. dep. by poor	0	0	0	0
Memo: Ave. sub. debt	0	1,538	6,029	14,445
Memo: Ave. net loan port.	1,414	4,598	10,086	21,755

Source: Financial statements of Pro-Crédito and Caja los Andes. Figures in thousands of nominal bolivianos.

Table 9: Trad. SDI for Andes

Organization	**Pro-Credito**	**Pro-Credito**	**Pro-Credito**	**Andes**
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Grants as rev.	0	0	0	0
Grants as equity	3,207	1,235	581	3,944
Disc. sub. debt	1	298	1,087	1,685
Disc. other op.	1,387	1,907	1,476	1,416
4 forms new sub. rsrc.	4,595	3,441	3,144	7,044
Open. accum. new sub.	0	4,595	8,036	11,180
True profit	(1,047)	(1,858)	(1,950)	(2,903)
Open. accum. true profi	0	(1,047)	(2,905)	(4,856)
Trad. subsidy	369	888	1,107	1,650
Trad. comp. subsidy	1,417	2,746	3,057	4,553
Trad SDI	211%	168%	78%	93%
On-lending I.R.	47%	36%	39%	23%
Subsidy-free on-lending I.F	148%	95%	69%	43%

Figures in thousands of nominal bolivianos.

Table 10: Mod. SDI for Andes

Organization	**Pro-Credito**	**Pro-Credito**	**Pro-Credito**	**Andes**
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Grants as rev.	0	0	0	0
Grants as equity	3,207	1,235	581	3,944
Disc. sub. debt	1	298	1,087	1,685
Disc. other op.	1,387	1,907	1,476	1,416
4 new sub. rsrc.	4,595	3,441	3,144	7,044
Open. accum. new sub.	0	4,595	8,036	11,180
True profit	(1,047)	(1,858)	(1,950)	(2,903)
Open. accum. true profit	0	(1,047)	(2,905)	(4,856)
Dividends	0	0	0	0
Alpha	1.000	1.000	1.000	1.000
Rho short-run	1.000	1.000	1.000	1.000
Rho long-run	1.000	1.000	1.000	1.000
Open. accum. short-run sub.	0	534	1,974	4,030
Mod. short-run sub.	534	1,440	2,056	3,204
Mod. short-run comp. sub.	1,581	3,298	4,006	6,107
Mod. short-run SDI	236%	202%	102%	125%
On-lending I.R.	47%	36%	39%	23%
Subsidy-free on-lending I.R.	159%	107%	79%	51%
Open accum. long-run sub.	0	534	2,096	4,600
Mod. long-run sub.	534	1,562	2,504	4,206
Mod. long-run comp. sub.	1,581	3,420	4,454	7,109

Figures in thousands of nominal bolivianos.

Table 11: Mod. subsidy for Andes from society

Organization	Pro-Credito	Pro-Credito	Pro-Credito	Andes
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Rho short-run	1.000	1.000	1.000	1.000
Rho long-run	1.000	1.000	1.000	1.000
Open. accum. short-run sub.	0	242	907	1,918
Mod. short-run sub.	242	665	1,011	1,548
Mod. short-run comp. sub.	1,289	2,523	2,962	4,451
Open accum. long-run sub.	0	242	932	2,042
Mod. long-run sub.	242	690	1,109	1,762
Mod. long-run comp. sub.	1,289	2,548	3,060	4,665

Figures in thousands of nominal bolivianos.

Table 12: Subsidy, DLR and pseudo-benefit-cost for Andes

Organization	**Pro-Credito**	**Pro-Credito**	**Pro-Credito**	**Andes**
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
$-years debt in period	395	1,182	2,400	4,699
Accum. $-years debt	395	1,576	3,977	8,676
Point of view of DFI				
Trad. subsidy	103	228	263	356
Mod. short-run sub.	149	370	489	692
Mod. long-run sub.	149	401	596	909
Accum. trad. sub.	103	331	595	951
Acc. mod. short-run sub.	149	519	1,008	1,700
Acc. mod. long-run sub.	149	550	1,146	2,055
Point of view of society				
Mod. short-run sub.	67	171	241	334
Mod. long-run sub.	67	177	264	381
Acc. mod. long-run sub.	67	245	509	890
Short-run DLR	0.00	0.02	0.05	0.08
Long-run DLR	0.00	0.02	0.04	0.06
Short-run DOR	2.8	2.4	3.5	2.8
Long-run DOR	2.8	2.5	3.0	2.9
PV dollar-years debt	375	1,066	2,058	3,828
PV social costs	64	160	226	310
Accum. PV dollar-years debt	375	1,441	3,499	7,327
Accum. PV social costs	64	224	451	761
Req. ave. debtor surplus (b)	0.17	0.16	0.13	0.10

Figures in thousands of dollars as of Dec. 31, 1995.

Appendix 1: The Parable of the Subsidized Servant

Measuring the subsidy received by a subsidized development finance institution is like a rich man who left home to go to a far country. He called his three servants to entrust them with some of his property. The rich man left most of his wealth with bankers who paid 10 percent, compounded twice a year, but he also left 10,000 shekels with each of the three servants. Then the rich man left on his trip.

The first servant went at once and left his money with the bankers. After a year, he got interest of $10{,}000 \cdot [1+(0.10/2)]^2 - 10{,}000 = 1{,}025$ shekels.

The second servant went and built a granary out of bricks. After a year it was done and it was worth 10,000 shekels.

The third servant went off, dug a hole in the ground, and hid his master's money.

After a year the rich man came back. He planned to take a trip again soon, so he called in the three servants to reckon the accounts. The first servant handed over the interest he had earned. "You gave me 10,000 shekels, sir," he said. "Look! Here is another 1,025." "Well done, good and faithful servant!" said his master. "You have been faithful in managing this amount, so I will leave you in charge of it."

Then the second servant came in and said, "Master, you gave me 10,000 shekels, and I built this granary, also worth 10,000 shekels. With your permission, I will rent it out next year." The rich man was doubtful, but he liked the servant and wanted to trust him. "You have worked hard in managing this amount, so I will leave you in charge of it. But when I come back, I want to get at least $10{,}000 \cdot [1+(0.10/2)]^4 - 10{,}000 = 2{,}155$ shekels."

Then the third servant came in and said, "Sir, I know you are a hard man; you reap where you did not sow, and you get a return where there was no trade. I was afraid, so I went off and hid your money in the ground. Look! Here are your 10,000 shekels." "You wicked and slothful servant!" his master said. "You knew, did you, that I reap where I did not sow and earn a return where there was no trade? Well, then, you should have put my money in the bank, and I would have got it all back now, with interest."

The rich man began to give the order that the third servant be sold as a slave, along with his wife, cattle, and other property, in order pay for the debt of the interest that the rich man could have collected. The third servant fell on his knees and began to wail and gnash his teeth. "Be patient with me," he begged, "and I will pay you everything." The rich man took pity on him and said, "You may go, but I want to get at least $10{,}000 \cdot [1+(0.10/2)]^4 - 10{,}000 = 2{,}155$ shekels when I come back."

Again the rich man left. The first servant went again and left his money with the bankers. In a year, he got 1,025 shekels. The second servant rented out his granary for the year for 2,000 shekels. The third servant crept behind the first servant, watching. He saw him leave his money with the bankers, so he did the same.

After a year, the rich man came back. He again called in the three servants to reckon the accounts. The first servant handed over what he had earned. "You gave me 10,000 shekels, sir," he

said. “Look! Here are another 1,025.” “Well done, good and faithful servant!” said his master. “Come on in and celebrate my return with me!”

Then the second servant came in said, “Master, I earned 2,000 shekels renting the granary I built with your money. Here it is!” The rich man grew angry and began to throttle the servant. “Fool!”, he said, “did you not know that I reap where I did not sow and earn a return where there was no trade? Well, then, you should have set the rent high enough to pay not only for the use of the 10,000 over the two years, but also for the use of the interest I could have received during the two years but instead allowed you to keep!” The second servant fell on his knees and began to beg. “Please sir, be patient with me,” he said. “Now that my customers know the granary is safe, I can earn more than enough next year to cover the losses so far.” But the rich man hardened his heart, and he had the second servant jailed until he could pay the debt of 155 shekels.

Then the third servant came in and said, “Voilà! You gave me 10,000 shekels, and here are another 1,025 that I have earned.” “You wicked and slothful servant!” his master began. “Did you not know that I reap where I did not sow and earn a return where there was no trade?” The rich man signaled for the jailer.

“Wait!” said the third servant. “If we ignore the fact that I did not pay you anything last year, then this year I got exactly what you could have got with the bankers.” The rich man stopped. The third servant said: “That is how the subsidy of DFIs is traditionally done.” The rich man gave in. “Well done, good and faithful servant!” he said.“Come on in and celebrate my return with me!”

Appendix 2: Calculations for the Grameen Bank

The appendix has technical notes on the calculations for the Grameen Bank. The financial statements are from Hashemi (1997) for 1983 to 1986 and from Khandker *et al*. (1995) for 1987 to 1994. In general, both subsidy and benefits have been underestimated while trying to replicate the assumptions and choices of Khandker *et al*. (1995) as closely as possible. When Khandker *et al*. (1995) veer from the logic of the traditional framework, it is always on the side of underestimating subsidy. Thus following Khandker *et al*. (1995) makes the results here both conservative and replicable.

For example, this paper follows Khandker *et al*. (1995) in ignoring the implicit subsidy enjoyed by Grameen from exemption from reserve requirements for deposits (Yaron, 1992a). This paper also follows Khandker *et al*. (1995) in taking the 3-year deposit rate at the end of each period as reported by the International Monetary Fund as the opportunity cost to Grameen for both subsidized debt and subsidized equity. Not only is would the correct rate be an average rate over a period, but also Grameen would not pay the 3-year deposit rate if it replaced its subsidized funds with market funds (Morduch, 1997). In addition, this rate does not have a premium for risk, nor does it distinguish between the opportunity costs of debt and of equity (Benjamin, 1994). Thus, the modified SDI here is still lower than it needs to be even though it is a higher lower bound on the subsidy received by Grameen than the traditional SDI in Khandker *et al*. (1995).

This paper also uses the annual averages of stocks in Khandker *et al*. (1995) when those average are not the simple average of the stocks at the opening and the closing of the period. The discount on subsidized debt follows Khandker *et al*. (1995).

Like Hashemi (1997) and Khandker *et al*. (1995), this paper pretends that Grameen did not exist before 1983. Excluding these years produces some erratic ratios in the first few years included in the analysis. Including the first years would increase the estimated subsidy because these years include fixed start-up costs and because economies of scale were still relatively unexploited. The increase in the estimated subsidy would be small, however, because Grameen was small and so its costs were small compared Grameen's later size and costs.

Some of the erratic ratios in the first few years are also explained by the fact that Hashemi (1997) is less detailed for 1983 to 1986 than is Khandker *et al*. (1995) for 1987 to 1994. Some assumptions had to be made for 1983 to 1986 that did not have to be made for 1987 to 1994. In particular, it was assumed that before 1987 there were no grants accounted for as revenue nor discounts on other operations. All debt from 1983-1986 was assumed to be subsidized, which is very close to the truth (Hossain, 1988).

This paper diverges from Khandker *et al*. (1995) in that all grants are counted as equity. Grants will not be repaid like loans. Grants are not even a residual claim on Grameen. Since the opportunity costs of debt and equity are assumed equal, this does not affect the results.

This paper also assumes that grants accounted for as equity caused any increase in equity not due to retained earnings nor to increases in paid-in capital. This causes some very small negative grants accounted for as equity in 1985 and 1986.

Khandker *et al*. (1995) ignore the fact that most of Grameen's shares are privately owned. In 1995, members owned about 85 percent of Grameen's shares, and the government of Bangladesh owned the rest (Hashemi, 1997). The modified estimates in this paper underestimate subsidy by assuming that all shares are privately owned. The SDI^T given here ignores private owners for comparability with Khandker *et al*. (1995).

This paper underestimates benefits by ignoring benefits accruing to Grameen's depositors and owners. In addition, the paper ignores any secondary benefits not accruing to customers of Grameen. It also ignores any benefits of the discipline infused by Grameen. Studies measuring the benefits of Grameen include Pitt and Khandker (1996), Goetz and Gupta (1996), and Hashemi *et al*. (1996).

Flows of nominal taka are converted to dollars as of Dec. 31, 1994 as suggested by Christen (1997). First, the nominal taka flows in a period are inflated to units as of the end of the period using the average inflation rate in the period as computed with monthly data from the International Monetary Fund. Then this figure is inflated to units of taka as of Dec. 31, 1994 according to the inflation between the end of the period and the end of 1994. Finally, the taka are converted to dollars with the exchange rate as of the end of 1994. The conversion factor in Table 13 incorporates these three steps. It was assumed that the annual rate of change in the conversion factor from 1983 to 1986 was the same as the annual rate of change between 1987 and 1989.

Table 13: Parameters and assumptions for Grameen

Organization	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**	**Grameen**
For the year ending	**31-Dec-83**	**31-Dec-84**	**31-Dec-85**	**31-Dec-86**	**31-Dec-87**	**31-Dec-88**	**31-Dec-89**	**31-Dec-90**	**31-Dec-91**	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**
Opp. cost sub. debt DFI	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.140	0.138	0.130	0.130	0.060
Opp. cost equity DFI	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.140	0.138	0.130	0.130	0.060
Opp. cost sub. debt society	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Opp. cost equity society	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.1
Any private owners?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Conv. flow Taka to 12/31/94 $	0.0524	0.0485	0.0449	0.0417	0.0381	0.0352	0.0322	0.0298	0.0278	0.0266	0.0266	0.0266
Weight rich taxpayers	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight poor debtors	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Social discount rate	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Periods from time 0	1	2	3	4	5	6	7	8	9	10	11	12
Discount factor	0.950	0.903	0.857	0.815	0.774	0.735	0.698	0.663	0.630	0.599	0.569	0.540

Appendix 3: Calculations for Caja los Andes

The appendix has technical notes on the calculations for Andes. The data was collected in Bolivia in 1995. In constant to Grameen, the only known subsidies that are omitted for Andes are some expenses for training paid by donors in 1992.

The opportunity costs of debt and of equity were based on the monthly average of the prime rate in Bolivia. A risk premium was added using the framework of Benjamin (1994). Still, the opportunity cost of debt and equity are lower than what Andes would probably pay in the market to replace its subsidized resources.

Annual averages of stocks are the simple average of the stocks at the opening and the closing of the period. Since Andes has grown quickly, this understates the true average, but it makes replication of the calculations easier.

Andes got a lot of subsidized resources as foreign consultants paid by donors. These expenses were valued at their cost to donors. Andes also got some grants accounted for as equity. About $100,000 accounted for as a loan without interest or due date was shifted to grants accounted for as equity. Andes has had some debt from market sources. Although Andes could take deposits in 1995, it did not take any until 1996.

All of Andes' equity is subsidized. When Pro-Crédito morphed into Andes in 1995, there was a façade that 10 percent of the shares were bought by private people. But donors gave these people the money they used to buy the shares. Pro-Crédito, itself nebulously owned, owns 60 percent of Andes. Donors own the other 30 percent.

Flows of nominal bolivianos are converted to dollars as of Dec. 31, 1995 as with Grameen.

Table 14: Parameters and assumptions for Andes

Organization	**Pro-Credito**	**Pro-Credito**	**Pro-Credito**	**Andes**
For the year ending	**31-Dec-92**	**31-Dec-93**	**31-Dec-94**	**31-Dec-95**
Opp. cost sub. debt DFI	0.228	0.229	0.232	0.255
Opp. cost equity DFI	0.208	0.205	0.193	0.197
Opp. cost sub. debt society	0.100	0.100	0.100	0.100
Opp. cost equity society	0.100	0.100	0.100	0.100
Any private owners?	No	No	No	No
Conv. flow Bs to 12/31/94 $	0.2790	0.2570	0.2380	0.2160
Weight rich taxpayers	1.0	1.0	1.0	1.0
Weight poor debtors	1.0	1.0	1.0	1.0
Social discount rate	0.05	0.05	0.05	0.05
Periods from time 0	1	2	3	4
Discount factor	0.950	0.903	0.857	0.815

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