

## **SymBanc™: A Simulator for Microfinance Institutions**

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### *Abstract*

*Microfinance institutions (MFIs) provide credit, savings, and other financial services to the poor and must successfully manage large volumes of small transactions in order to remain viable. SymBanc™ is a system dynamics simulator designed to introduce students to the complexities of managing a Microfinance Institution (MFI) or to engage experienced practitioners in a discussion of the key determinants of success in such a dynamic, complex environment. The simulator allows students to grow an MFI from a single branch to a large network by making a variety of decisions about target market, staffing and facilities, loan and savings product design, and sources of external funding. This paper begins with some background on Microfinance Institutions and then presents the structure of the model underlying SymBanc™ and results of typical simulations. Initial experience using SymBanc™ and future enhancements contemplated for it are also described.*

Key words: microfinance, economic development, simulators, learning environments

## Introduction

Microfinance institutions (MFIs) provide financial services to the poor, mostly credit and savings services. The amounts of money handled in any one transaction are very small and the transaction costs are high relative to the amount involved. Over the years microfinance institutions have developed a number of strategies for reducing transaction costs. A key driver of success is the ability to achieve economies of scale through volume, effective management of information flow, and effective action based on that information. For an MFI to be successful, it must be a large, dynamic organization requiring many operational and strategic management decisions made on a daily, weekly, monthly, and annual basis. MFIs need to meet growth and break-even/profit targets and social impact targets as well. To achieve these targets, management must decide on

- the right mix of personnel (field and office staff);
- the geographical distribution of offices;
- whether to offer individual loans or loans to groups;
- the amount of information to be gathered;
- an interest rate structure that will yield sufficient demand for credit and supply of savings;
- many other factors.

A system dynamics simulation game is an effective way to

- introduce students to the complexities of managing an MFI, or to
- engage experienced practitioners in a discussion of the key determinants of success in such a dynamic, complex environment.

Simulators such as SymBanc™ have been developed and used in diverse fields including health care and the newspaper industry (Hirsch and Immediato, 1998; Hirsch et al, 2003)

We developed SymBanc™ for these two purposes, for use in both degree programs and Executive Education. The game gives students the opportunity to set up an MFI providing services to a market of their choice and then to run it, with control over most of the key operational variables that the manager of an MFI might have. Through playing the game multiple times, and under different pre-set environmental scenarios that deliver, for example, exogenous shocks at a particular time, the students can learn how the decisions they make feed through the system and affect their financial and client outreach results. In the discussion of the game, the instructor has the opportunity to elicit from the students suggestions as to what important causal connections there are in the system, how they interact, and what they say about the way in which MFIs work.

The remainder of this paper provides an overview of the field of microfinance, some more background on the pedagogical impetus behind the development of SymBanc™, and a detailed discussion of the simulation. This last section describes a variety of different management strategies and the results they generate. SymBanc™, as described in this paper, is thought of as a prototype, Version 1, with future versions having considerably more functionality and reflecting a much wider range of products, customers, markets, and economic conditions. The final section of this paper lists a set of enhancements contemplated for future versions.

## Overview of Microfinance

Microfinance is the provision of financial services to the poor, largely in developing countries. The finance is “micro” because the poor can only afford to save, borrow, or buy insurance in small amounts. Microfinance is most commonly identified with the provision of credit to micro-entrepreneurs, but this is only one part of the services that microfinance institutions supply. Microfinance institutions (MFIs) often also supply savings services, and many provide a basic insurance policy that covers the outstanding balance on a loan owed to the microfinance institution. Payment and transfer services are also common MFI products, especially moving money between rural and urban areas. Several good sources provide a more in-depth introduction. (Ledgerwood, 2001; CGAP).

Probably the most famous MFI in the world is the Grameen Bank in Bangladesh. Grameen got its start by providing microcredit to poor women in 1976 and has since grown to over 3 million clients. The largest MFI is Bank Rakyat Indonesia, which has about 3 million borrowers and 30 million savers in its Microbanking division. Estimates of the size of the microfinance industry are hard to establish accurately. The Microcredit Summit has been gathering data on *micro-credit* since 1997, when it reported that 618 institutions were serving about 13.5 million clients. Its latest report contained information on the activities of about 3,000 microfinance institutions with about 81 million active clients (Microcredit Summit, 2004). These data should be considered rough estimates of the extent of micro-credit activities.<sup>1</sup> On the savings side there has been less systematic data gathering. As noted above, Bank Rakyat Indonesia alone serves 30 million savers and all the very large MFIs active in Bangladesh now provide savings services.

The vast majority of the microfinance activity in the world takes place in Asia, in particular in South and South-East Asia. In Bangladesh alone the four largest MFIs had about 10 million active loan clients as of the end of December 2003, more than the combined total of active loan clients in Africa and Latin America (see Table 1).

<u>Region</u>	<u>Active Loan Clients</u>
Africa	6.4 million
Asia	72 million
Latin America and Caribbean	2.5 million
Middle East	106,000
Developed World	218,580
World Total	81 million

Source: Microcredit Summit, 2004

Table 1: Active MFI Loan Clients by Continent

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<sup>1</sup> An active client is one who had an outstanding loan balance at the time that the MFI reported its data, which, for the 2004 report, was December 31, 2003. Though the Summit makes a good effort to ensure that the data they receive from the institutions reporting to them are accurate, through third-party verification, there is clearly some exaggeration in the reports, especially given the poor quality of the services that some MFIs provide.

Microfinance is a volume business, for both financial and non-financial reasons. As is the case with all financial institutions, MFIs earn revenue by charging interest on the loans they make. Their revenues on each loan are small, proportional to the size of the loans they make. Yet it can cost as much to process an application for a small loan as it does to process an application for a large loan. It also costs as much to take in a small savings deposit as it does a large savings deposit. An MFI must keep its transactions costs down. It does this through innovative strategies for originating loans and taking in savings, and through volume – serving a large number of clients – to take advantage of economies of scale. The greater the number of clients served the lower the overhead costs per client. This is the financial imperative behind the drive for volume. The non-financial imperative is the desire of MFIs to reach as many poor people as possible with their services. There clearly is a demand for financial services of all types, which is currently being met in places by informal providers. MFIs believe they can provide a better service at a lower price in a market that has considerable room for growth.

To encourage volume lending, MFIs often provide commission-based incentives to their loan officers through which they earn considerable additional income each month, over and above their base pay. As a result, in many of the large, financially sustainable MFIs, each loan officer will serve between 300 and 400 clients. MFIs also provide salary-deduction incentives to ensure that, in their drive for volume, loan officers do not sacrifice portfolio quality. Despite MFIs' efforts to keep costs down, the interest rates they charge are still high, relative to those prevailing in the developed world. In Latin America the nominal interest rates MFIs charge can be as high as 100%, on an annualized basis. In Asia they are lower, in the range of 12% to 36% depending on the country and the policy of the MFI, but still higher than the rate a commercial bank charges its established commercial customers.

Once loans have been granted, managing the repayment process and minimizing delinquencies and defaults is critical to an MFIs performance. This requires good information. Microfinance is an information business, as is the case with all types of financial institution. Unlike other financial institutions, much of the information that an MFI has about its clients is based on what the clients themselves tell the MFI, what the MFI can find out from people who know the clients, and what the MFI learns about the client after they have extended the first loan to them. There is very little official documentation that goes with a loan application. This keeps the paperwork down, but also means that the MFI has to proceed carefully with the borrower. The need to proceed carefully is behind three common strategies MFIs use: aggressive delinquency management, step-lending, and reputation building.

- **Delinquency management** requires good information systems. Many of the large MFIs, especially in urban areas, have fairly sophisticated Management Information Systems (MIS), which allow them to track their clients' repayment activity on a real time basis. For example, Sogesol, an MFI serving Port-au-Prince and other cities in Haiti, provides its loan officers with data on all their clients who did not make their monthly loan payment, on the day after the payment was due. The loan officers act on this information as soon as they receive it, by finding the client and informing them of their need to make the payment (plus a late-payment fine), so that the borrower does not fall behind on their payments.

- **Step lending** is a process by which an MFI first makes small loans to a borrower, and, as they get to know that borrower better, they make larger loans. With each step, they take on a greater risk but have better information with which to gauge that risk. Once again a good MIS is critical to the process, because the MFI must have easily accessible data about each client's record in repaying their previous loans. Furthermore, a good MIS is important to enable management to monitor the performance of the loan officers to ensure that they are making high-quality loans in a cost-effective manner.
- Many MFIs work hard to maintain a **reputation** as a fair but firm financial institution – one that is ready to make new loans to its clients that repay their loans, but does not easily forgive loans in default. This is important because the MFI has to rely on the commitment of its clients to the institution as the strongest line of defense against defaults and losses.

The final challenge, in addition to generating volume and tightly managing repayment, is identifying the right market. The market for microfinance services is diverse, but MFIs often pursue a strategy of targeting one market niche. Two important choices facing MFIs when they determine their market niche are should they serve

- women only, or women and men?
- a rural or urban area?

The answer to the first question depends on the mission of the MFI and the local gender structure. In many regions of the world women have a subordinate status in the household and in the labor, production, and services markets. Targeting women means that the MFI is reaching individuals who are engaged in the least remunerative activities in the local economy and therefore those individuals who earn the least income and might benefit the most. This is true in theory, but the fungibility of money makes it hard to track, and often the loans made to women end up in the hands of their husbands. Nevertheless, Hashemi *et al.* (1996) show that lending to women can alter the status of women in the household. And Pitt and Khandker (1998) show that when the money passes through the hands of a woman there is a greater impact on the welfare of children than if the loan is made directly to a man. As a result, many MFIs target women as a way to empower them within the household, to increase their chances of having an impact on the household as a whole, and to raise their incomes in the economy.

The other important choice an MFI makes is whether it is going to serve an urban or a rural population. By definition, urban areas are more densely populated than rural areas, and rural areas are, of course, where agricultural production takes place. These two facts have an important impact on the operations and product offerings of an MFI. In an urban setting the transaction costs are lower because the potential clients of an MFI are often concentrated in one place, and the loan officer can easily walk from one client to the next in a short amount of time. In rural areas distances are greater and roads in poorer conditions. Though rural non-farm activities account for between 32% and 42% of rural household income depending on what region you are in (Reardon, 1998), much of the economic activity of rural areas follows the cycle of the planting, growing, and harvesting seasons. As a result, loans in rural areas must also

match that cycle, which means they have longer terms – 8 months to a year. In urban areas, typical loan terms are four to 6 months.

In sum, microfinance is a growing service industry, serving vast numbers of poor people. It is a volume business, to achieve both maximum outreach and financial sustainability, but must carefully balance the desire for volume with the need for quality. Volume entails the execution of a large number of transactions involving small amounts of money in each transaction, putting huge cost pressures on MFIs. Those transactions also carry with them information about the payment activity of each client, which must be processed and acted on in a timely manner. And these activities take place in diverse market niches structured by gender relations and rural-urban differences, but which share in common a lack of easily, formally documented information. MFIs must manage complex dynamics inherent in their own operations and in their on-going relations with their clients to maintain their financial viability.

### **Teaching Microfinance**

SymBanc™ was developed initially for the Financial Institutions for Private Enterprise Development (FIPED) Executive Program and for a degree program course on microfinance at Harvard University's Kennedy School of Government. (For more information on FIPED, see <http://ksgexecprogram.harvard.edu/ProgramList.aspx>.) It was created as a “virtual bank” based on system dynamics simulations of real policy and operational environments to make FIPED pedagogy more interactive, and thus, enhance FIPED's educational impact. SymBanc™ was financed with a grant from the Provost's Fund for Instructional Technology, a special financing facility established by Harvard University to encourage innovation in teaching through the creative application of information technology.

FIPED is a two-week program for professionals working in the areas of micro enterprise finance and commercial banking for small- and medium-sized businesses, and is designed to aid participants in the sustainable provision of financial services for micro, small, and medium enterprises (MSMEs). The course shows how to design appropriate financial instruments and to adopt market-oriented management approaches to serve the needs of MSMEs. The goal of the program is to offer financial institutions the management skills and operational tools necessary to operate in a market economy, while teaching participants how to introduce and implement strategies that will enable them to profitably finance the creation and growth of MSMEs. FIPED also gives senior government officials an understanding of the macro policies and enabling environment needed to support sustainable MSME finance.

Since its inception in 1995, FIPED has attracted an outstanding group of executives from 89 countries working in financial institutions, governments, non-governmental organizations, and international agencies. FIPED faculty includes well-known professionals from Harvard University and experienced practitioners from premier financial institutions. In addition, FIPED faculty members are engaged internationally in advising and training organizations in the creation and management of profitable and sustainable financial institutions.

FIPED consists of core lectures, applied case studies, practical exercises, and presentations of participant experiences within different countries. Participants work in groups to complete and

present a series of case studies illustrating new management and finance techniques applicable to the daily operations of financial institutions. Participants also undertake a structured series of intense negotiations in role-playing scenarios and make regular presentations of their analyses.

The degree program course on microfinance (PED-328, accessible from <http://www.ksg.harvard.edu/gstuart/courses.htm>) introduces students to the field of microfinance. It covers a wide variety of institutions from for-profit subsidiaries of commercial banks to member-owned, rural cooperatives. It orients students to the diverse markets for microfinance services, including micro-enterprise credit, savings, micro-insurance, and housing finance, and the managerial and strategic challenges of serving those markets. In this context SymBanc™ serves as a case study that focuses attention on the way in which a typical microfinance institution might grow and maintain itself.

SymBanc™ covers material previously taught using more conventional methodologies such as lectures with discussion, case studies, and electronic spreadsheets. These topics include financial institution sustainability, breakeven and profitability analysis, and interest rate concepts and calculations. SymBanc™ makes complex conceptual and operational interactions easier to appreciate by requiring the active participation and sophisticated application of dynamic problem solving skills by its users. Readers of this paper should feel free to try SymBanc™ themselves – it can be downloaded for free at the following URL: <http://www.ksg.harvard.edu/cbg/asia/symbanc.htm>

### **The Simulation Model That Powers SymBanc™**

The model underlying SymBanc™ represents most of the functions of a microfinance institution (MFI) serving a population of two million in a region where two-thirds of the people live in rural areas. Average income in the region is \$900(US) with significant inequality in distribution. The lowest quintile has an average income of \$200 while the highest has an income of \$2,700.

The MFI is able to offer trade or agricultural loans to existing and/or new enterprises and can elect to take savings deposits as one source of funds for lending. Users of the simulator start with a single branch and its staff. They choose the target population to serve, design the loan products offered, make decisions about staffing, expansion of the branch network, investments in information systems and other capital assets, and select external sources of funds for capital. Some MFI functions such as lending to small and medium enterprises (SME's) and consumer loans to civil servants and other salaried employees are excluded for the sake of simplicity as well as the budgetary and schedule constraints of the initial development effort. These features may be added later as would the ability to lend for trade and agriculture simultaneously.

Figure 1 provides an overview of the model's structure. As shown in Figure 1, the number of borrowers attracted at each point in time is the result of

- the MFI's strategy and how it defines its target market,
- the area's demographics,
- design of loan products (e.g., interest rate and payment terms; group, individual, or both) and their appeal to the target market, and
- numbers and experience of loan officers and staff and extent of the branch network.

The loan portfolio grows as new borrowers are attracted as long as there are enough funds available from both internal (retained earnings and savings) and external sources (donors, commercial banks, and governmental revolving loan funds). The size of the loan portfolio over time depends on the number of borrowers, sizes of loans, distribution of borrowers across three stages in which loans grow by certain increments, and extent to which borrowers are able to repay their loans.

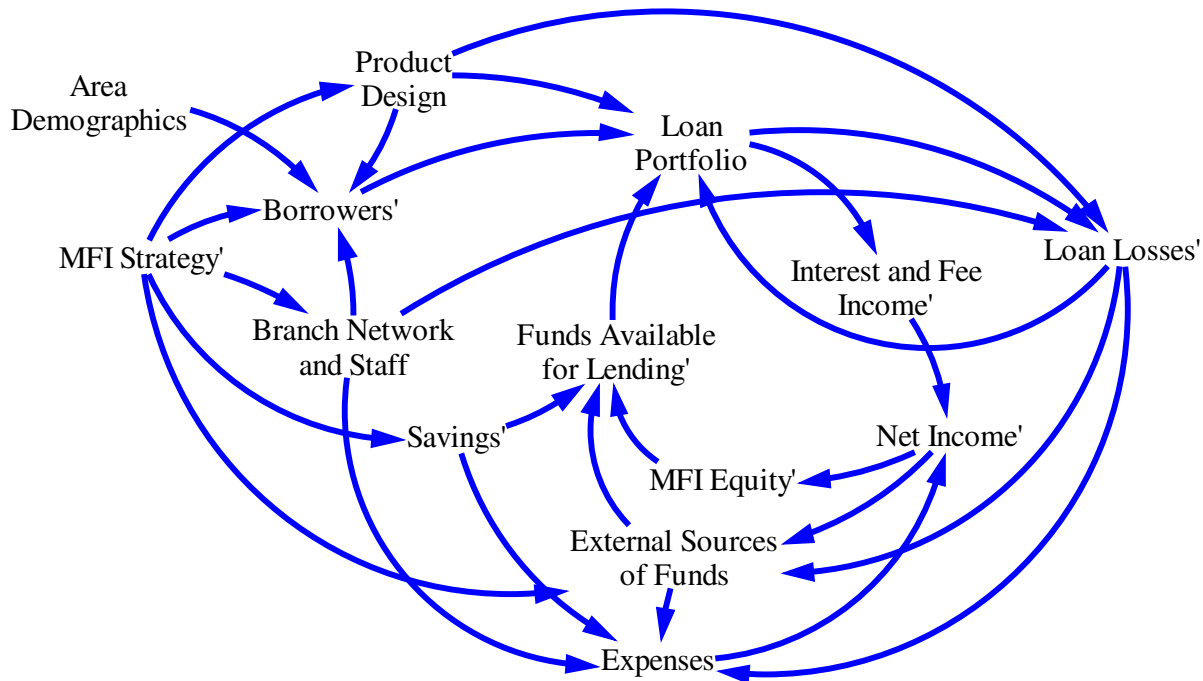


Figure 1: Overview of the Microfinance Institutions Model

The size of the portfolio and design of loan products determine the revenue stream and, in turn, the MFI's net income. Expenses include the costs of staff and the operating the branch network, loan losses, interest costs on funds borrowed from external sources, and interest paid on savings. Loan losses reflect the size and quality of the loan portfolio, investments in information systems, and attention of loan officers to preventing and managing delinquent loans. Net income over time determines the value of equity in the MFI and the willingness of external agencies to make funds available for lending.

Figure 2 provides some additional detail about the MFI model's structure and how it functions. As shown in figure 2, starting from the left-hand side, users of the simulator define the target population whether they want to lend to

- men and women or women only,
- existing or new businesses or both, and
- certain income groups or let the market determine the income profile of their borrowers.

That target market and its reaction to the loan products offered along with marketing efforts by loan officers will determine the numbers of applicants for group and individual loans.

Applicants become borrowers as long as there is enough loan officer effort dedicated to



processing applications in a timely manner and there are sufficient funds available to cover the new loans. Borrowers move through three stages defined by the size of the loans they take and, at each stage, can repay the loan and advance to the next stage, repay the loan and drop out, or become delinquent. Group and individual borrowers are tracked separately through these stages. Delinquent borrowers may cure their delinquencies and become borrowers in good standing again or may default on their loans. Defaults add to loan losses and reduce repayments and funds available for lending.

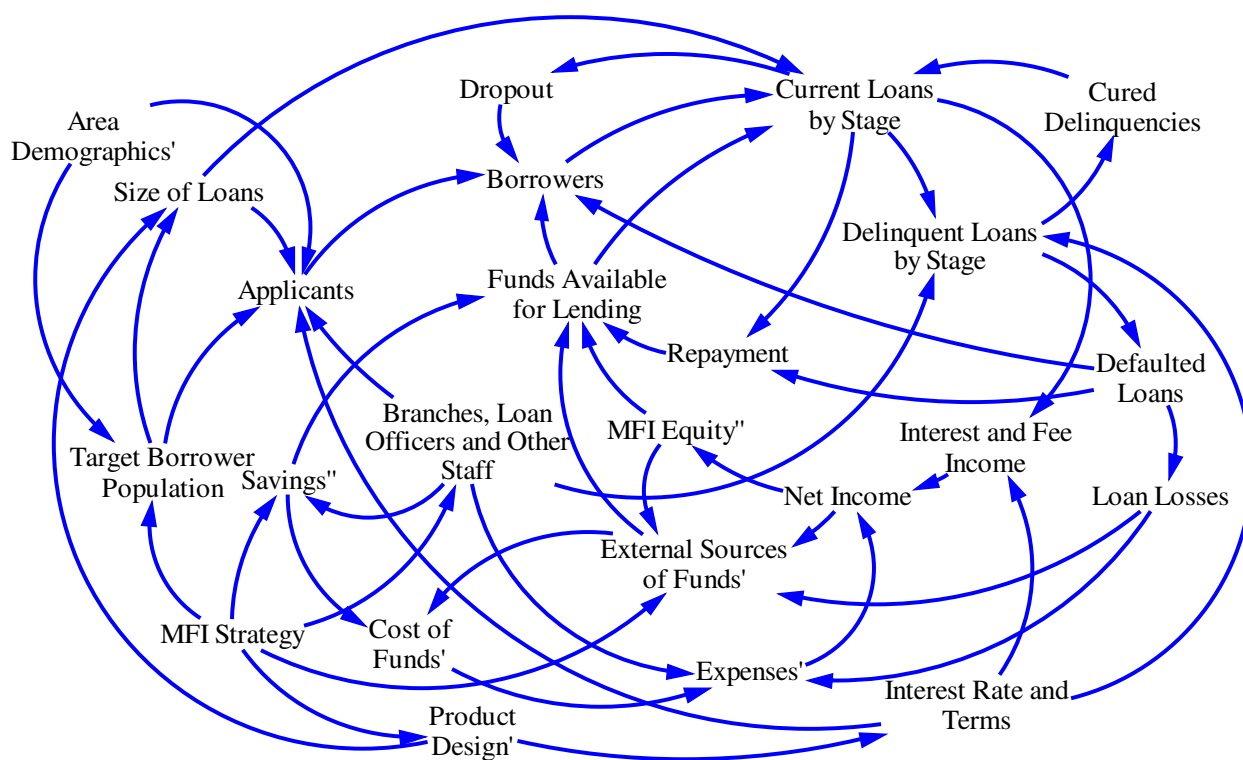


Figure 2: More Detailed Look at Microfinance Institutions Model

The model contains an elaborate set of factors that determine rates of delinquency and default including

- loan officer experience, incentives, and effort devoted to managing relationships with borrowers,
- the quality of the loan portfolio,
- investment in information systems that can track delinquencies,
- the size of loans at each stage relative to average income of the target population,
- conditions of loans such as collateral requirements, late payment penalties, and compulsory savings, and
- exogenous environmental factors such as crop failures and macroeconomic shocks.

The quality of the portfolio, in turn, depends on other factors such as the interest rate and size of loans. For example, borrowers seeking large loans and willing to pay high interest rates are assumed to be poor credit risks who have been turned down by commercial banks and other sources of credit.

The size of the loan portfolio and interest rates and loan fees determine the flow of interest and fee income during each time period. A variety of expenses are subtracted from these revenues including salaries and overheads of the branch offices, loan losses, and interest paid on any savings deposits and funds borrowed from external agencies. The model includes elaborate structures for tracking hiring and retention of loan officers, other staff, and managers and calculating the average experience of each type of staff. It also determines levels of voluntary and compulsory savings that can be obtained from depositors based on levels of service and interest rates offered and the perceived financial stability of the institution.

The MFI's ability to attract funds from external sources depends on its profitability (greater than 2.5% of revenue), the equity it has accumulated (equal to 12% or more of loans outstanding), and the rate of loan defaults it experiences (limited to 4%). Elements of the MFI's strategy such as its decision to serve women exclusively or people in lower income groups will also give it greater access to donor funds with more favorable terms, as long as its loan default rate remains below 5%. The MFI can also raise additional equity after several years of operations if it is profitable and can limit its loan losses.

### **SymBanc's™ User Interface and How the Game is Played**

Users take their MFI from startup through eight-year simulations. They begin by choosing the characteristics of the target market that then remain the same for the remainder of the simulation. They also select an initial set of features for the loan products they offer and make other decisions regarding hiring and branch office expansion, whether to accept savings and what interest rates to offer, and how much to invest in things such as information systems. As users move through a simulation, they have access to a rich array of information about the MFI's borrower population and loan portfolio and its financial performance. Based on this information, they can alter their decisions as often as monthly, though they more typically might change things on a yearly basis. Simulations continue for the full eight-year period unless the MFI runs out of money.

The simulator has an interface with a number of screens for inputting decisions and other screens that display results as a simulation proceeds. Figure 3, for example shows the decisions users have available to them in designing their loan products. There are a wide array of parameters including size and term of loans, interest rates, frequency of payment, and other features such as collateral requirements, compulsory savings, built-in penalties for late payment, and whether interest payments are calculated on a straight interest or declining balance basis.

All of these decisions about product design have tradeoffs for the user. High interest rates, for example, bring greater revenues, but may make the loans unattractive to everyone except those who are a poor credit risk and cannot obtain loans elsewhere. Large loans may also generate more income for the MFI, but can be more difficult for the borrower to repay and lead to larger loan losses. (The screen displays the size of the monthly payments relative to average income of the target population.) Long terms may reduce the monthly payment, but may make the loan's overall cost too high. Collateral requirements may reduce the likelihood of default, but make the loans less attractive to potential borrowers as well as creating an additional administrative burden

for loan officers. It may take a number of simulations for users to figure out the right set of loan characteristics for the target population they have selected.

Figure 3: Decision Screen for Designing Loan Product

Figure 4 shows the screen for making decisions about staffing and investments in facilities and equipment. Users can set goals for hiring loan officers, other staff, and managers and set salaries for each of those positions. They can expand or contract the branch network and decide on investments in computers and vehicles. They can also allocate time of loan officers among various activities and create incentives that cause loan officers to emphasize one of the functions shown such as attracting new borrowers or reducing delinquencies. Other decision screens let users choose to take savings and set interest rates and select the sources, subject to meeting criteria discussed earlier, from which they would like to draw capital.

Figure 5 shows one of the screens that display results, in this case a traditional “P&L” statement along with a graph of revenues and expenses. The button below the graph gives users access to the balance sheet as well. The other buttons at the bottom of the screen enable users to “drill down” and understand what is going on in greater detail. For example, clicking on the button “Applicants and Borrowers” leads them to the screen shown in Figure 6 that shows numbers of applicants and borrowers currently on the rolls of the MFI segmented by group and individual loans and borrowers by the stages (sizes) of the loans they hold. The buttons below the tables provide graphs of key drivers of applicants and borrowers.

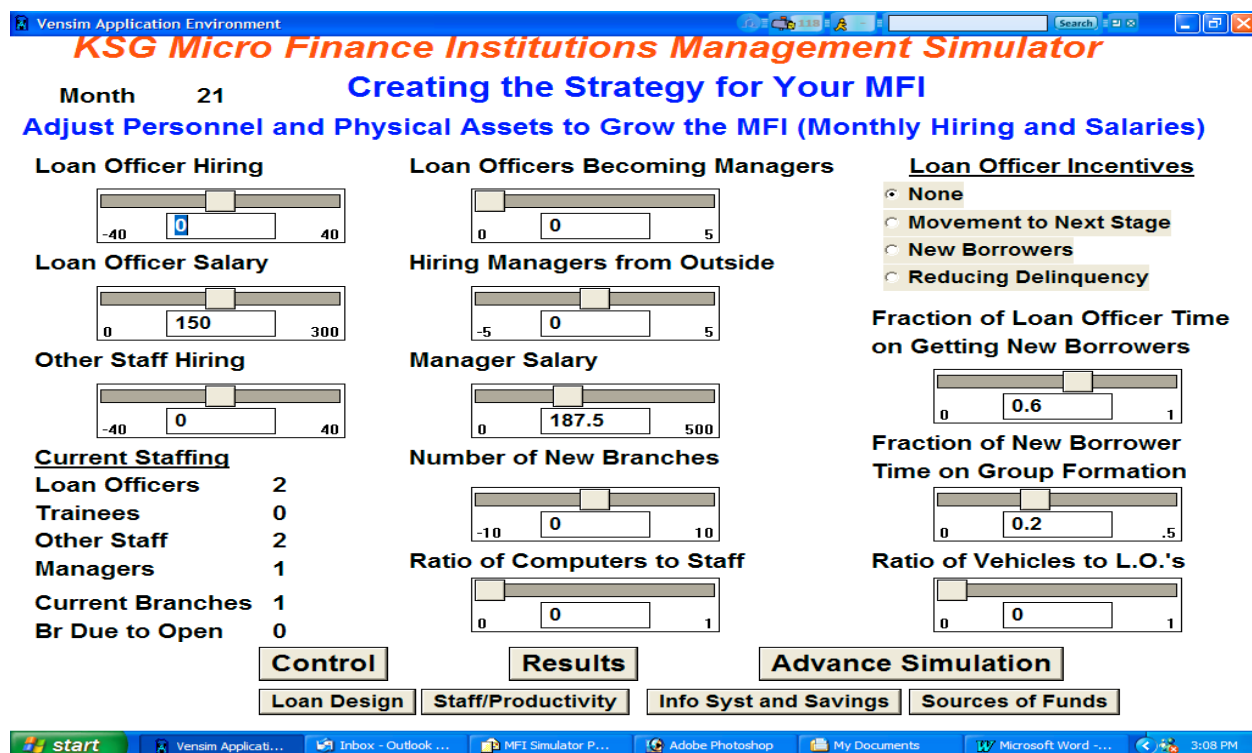


Figure 4: Decision Screen for Staffing, Salary, Time Allocation, Incentives, Branch Network, and Investments in Physical Assets

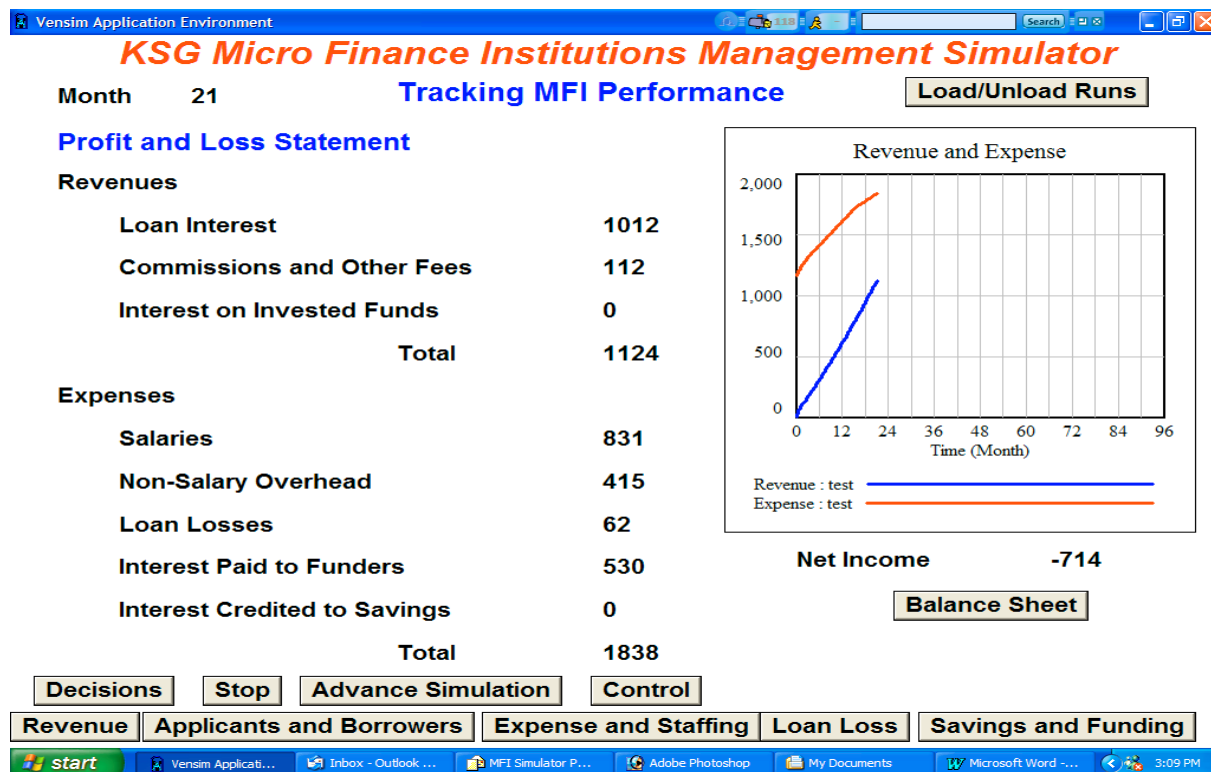


Figure 5: Results Screen with Profit and Loss Statement and Graph of Revenue and Expense

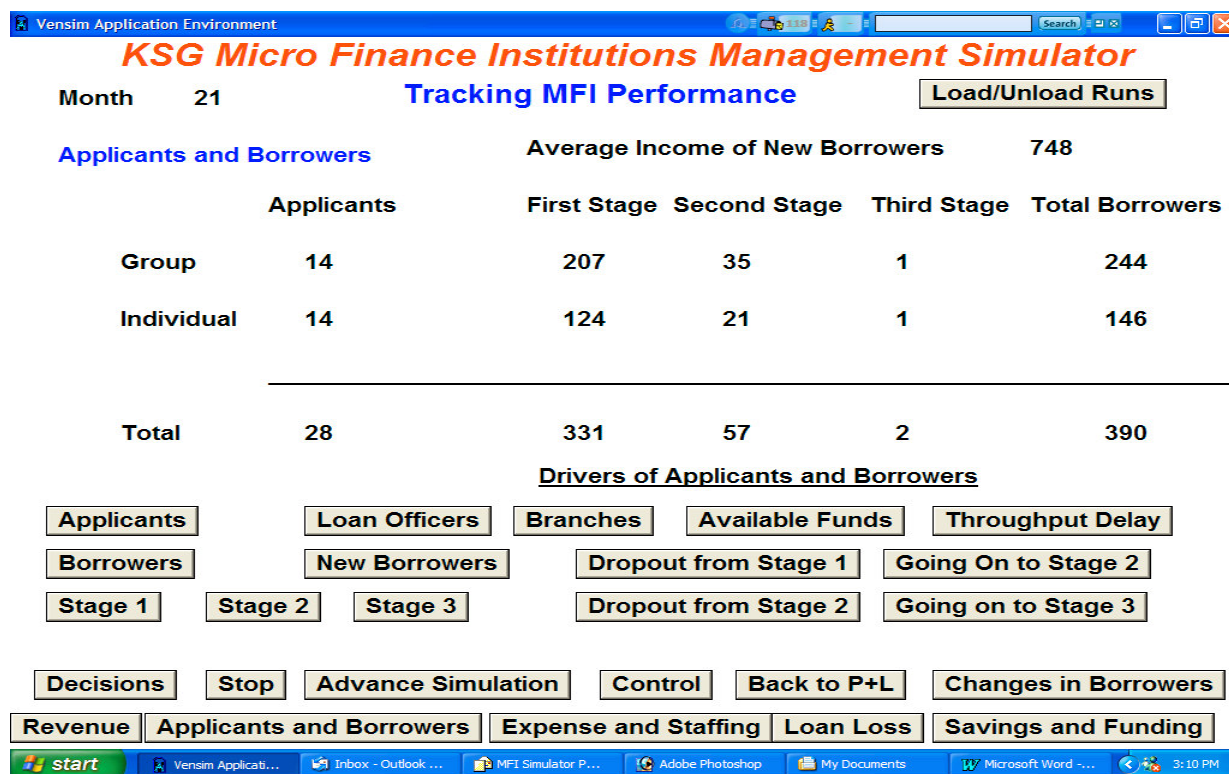


Figure 6: Detailed Results Screen Displaying Applicants and Borrowers

When the number of borrowers is declining or not increasing as fast as one would hope, clicking on these buttons will help users understand what is driving this result or impeding the growth in borrowers. The graphs enable the user to compare results for each variable for up to the previous four simulations. Figure 7 shows what the screen would look like with these “pop up” graphs produced by clicking on the “Loan Officers” button and on the one for “Applicants”. As indicated by the buttons at the bottom of the screen, these in-depth analyses can also be done for revenue, expense and staffing, loan loss, and savings and funding.

The simulator also has several built-in scenarios to test the mettle of its users. The user (or instructor) can select one of these scenarios that include a limitation on available funds or various combinations of economic shocks that affect borrowers’ ability to repay their loans.

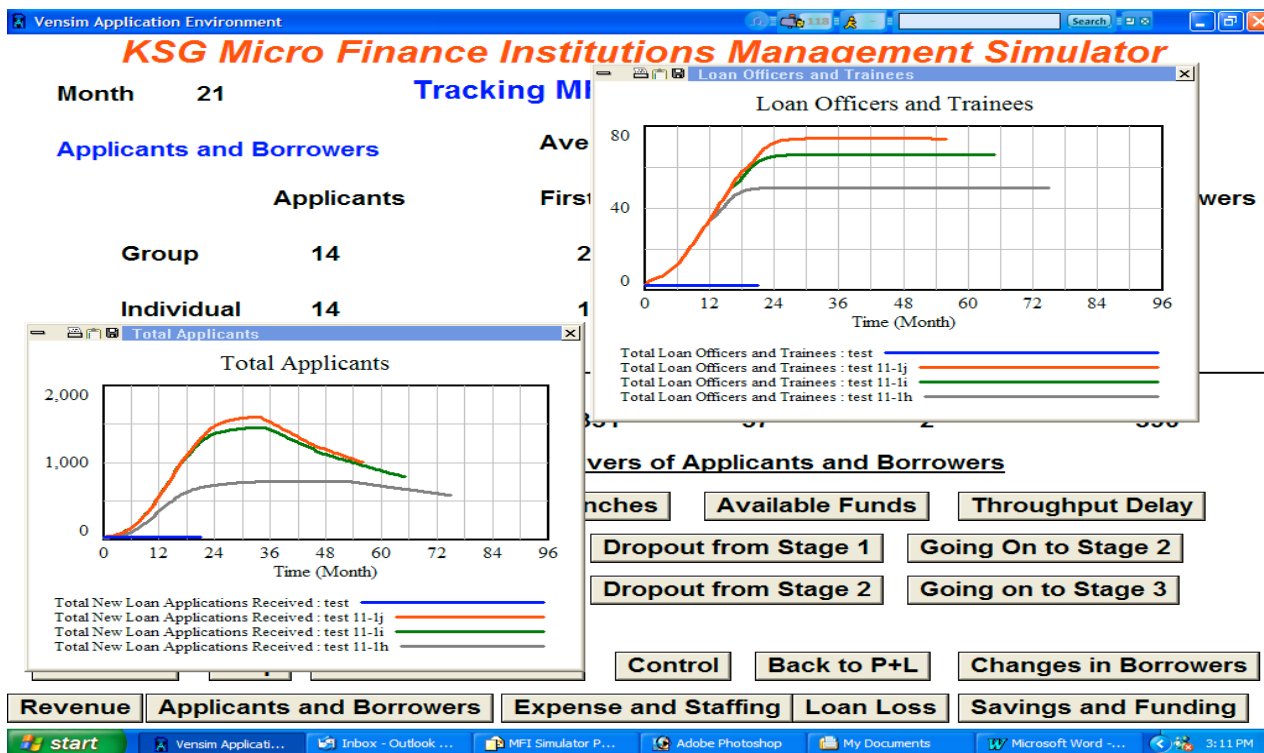


Figure 7: Applicant and Borrower Screen with Pop-Up Graphs Displayed for Loan Officers and Trainees and for Total Applicants

### Some Typical Results with SymBanc™

This section displays three sets of results to illustrate the kinds of performance that users might encounter as they employ various strategies for growing their MFI. These simulations are meant to be illustrative and represent only a small fraction of the variations that can be tried with the MFI simulator. Table 2 at the end of the paper summarizes the strategies that are described and the results they produce and can serve as a guide to the discussion of results.

#### A. Common Mistakes That an MFI Might Make

The first set illustrates the consequences of several potential miscalculations that lead to faulty strategies and running out of funds before the end of the eight-year period. In each of the simulations described in this section, the MFI has an initial “growth spurt” as it adds one branch per month for the first twelve months and then stops adding branches for a while. Names of simulations are shorthand descriptions of the strategies employed and correspond to the graph lines on displays of results in Figures 8 through 18.

- **Low income, more donor money** reflects a mismatch between products offered and the target population selected. The MFI decides to target lower income borrowers because this will cause donor agencies to be more generous with funding. (In the simulations, donors are assumed provide a maximum of \$5 million if MFI’s target only low-income borrowers (lowest two quintiles) and/or women vs. \$3 million if they do not do means testing and make

loans available to borrowers at all income levels.) However, the MFI tries to grow rapidly by insisting that borrowers take larger loans than their income might comfortably allow them to repay.

- In **low price, high volume** the MFI tries to build its borrower population quickly by charging a low interest rate (by MFI standards) of 1% per month and going after the entire population rather than just low income borrowers.
- The MFI charges a competitive rate in **high growth**, goes after the entire population (not just lower income), and manages to break even after 30 months. It “celebrates” by drawing down all of the \$3 million available from donor agencies and beginning an expansion program that attempts to add one new branch per month for the remainder of the simulation.

Results of these three simulations are presented in Figures 8 through 11. As shown in Figure 8, the first simulation (*low income, more donor money*—green line) shows the MFI attracting only a limited number of borrowers because the loans are unattractive. Furthermore, as indicated in Figure 9, the difficulty in repaying the loans for those who do take them results in a sufficiently high default rate (over 5%) that the donor agencies cut off additional funding and the MFI runs out of money after about 60 months.

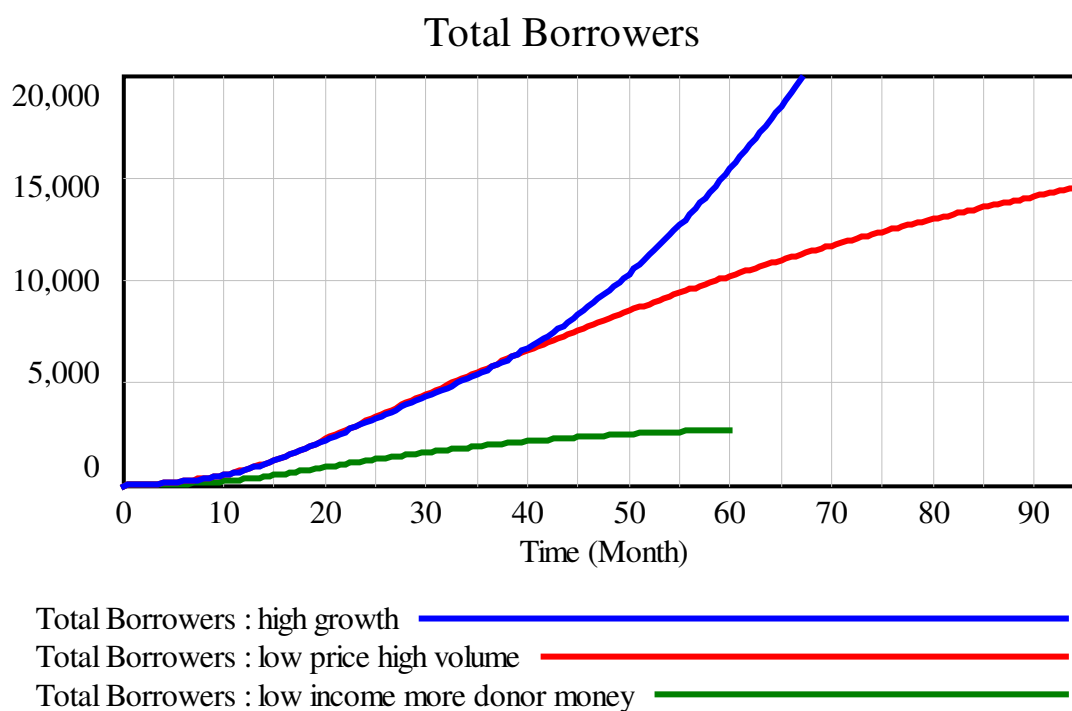


Figure 8: Total Numbers of Borrowers in Three Scenarios with Growth Strategies That Fail

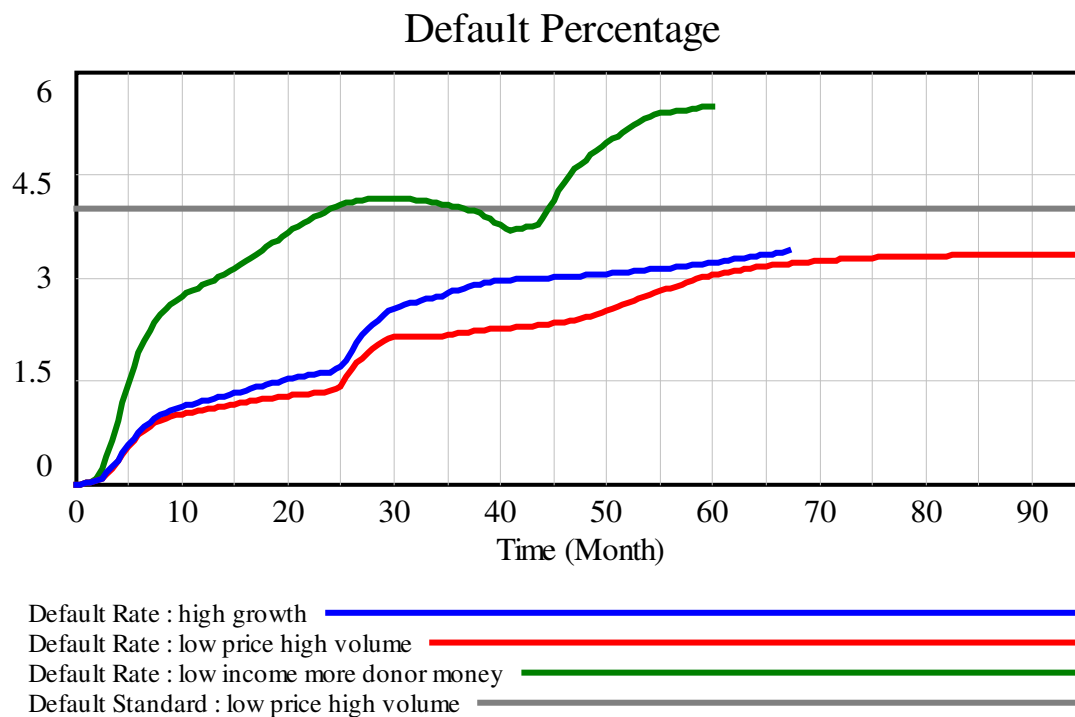


Figure 9: Default Percentage in Three Scenarios with Growth Strategies That Fail

The second strategy in which a lower interest rate is charged to attract more borrowers clearly has that effect, as shown in Figure 8 (by the red line—*low price high volume*). Loans are also well matched to borrowers, as indicated by the red line in Figure 9 that only reaches a default rate of about 3%. In this simulation, the MFI takes advantage of the maximum amount of funding available from donor agencies in month 20 and is able to grow its borrower population for a while. However, it continues to lose money because of the low interest rate being charged and cannot meet the profitability standard of the various external funders. The MFI makes it almost to the end of the 96-month simulation, but runs out of money at 95 months just as it breaks even, once it exhausts the funds obtained from donors.

In the third simulation, the MFI appears to have a product that is well matched to the general borrower population it is targeting and an interest rate that is sufficient to make it profitable by early in the simulation. Its accelerated growth after month 30 produces a sharp increase in borrowers, fueled by the maximum amount of funding from donor agencies, as shown in Figure 8 (blue line—*high growth*). Why then, does the MFI “hit the wall” in month 66 when it runs out of money for new lending? Why couldn’t it raise money from external funders such as commercial banks and government revolving loan funds or the bond market? The blue line in Figure 9 indicates that it has kept its default rate below the 4% standard. Similarly, its profitability is exemplary, well above the minimum of 2.5%, as shown by the blue line in Figure 10. However, as indicated by the blue line in Figure 11, putting money into growing and staffing the branch network has taken its toll and kept the MFI from building up equity equal to 12% of funds loaned that external funders require. Equity almost reaches that point, but the MFI runs out of money before it can qualify. Close, but no cigar.



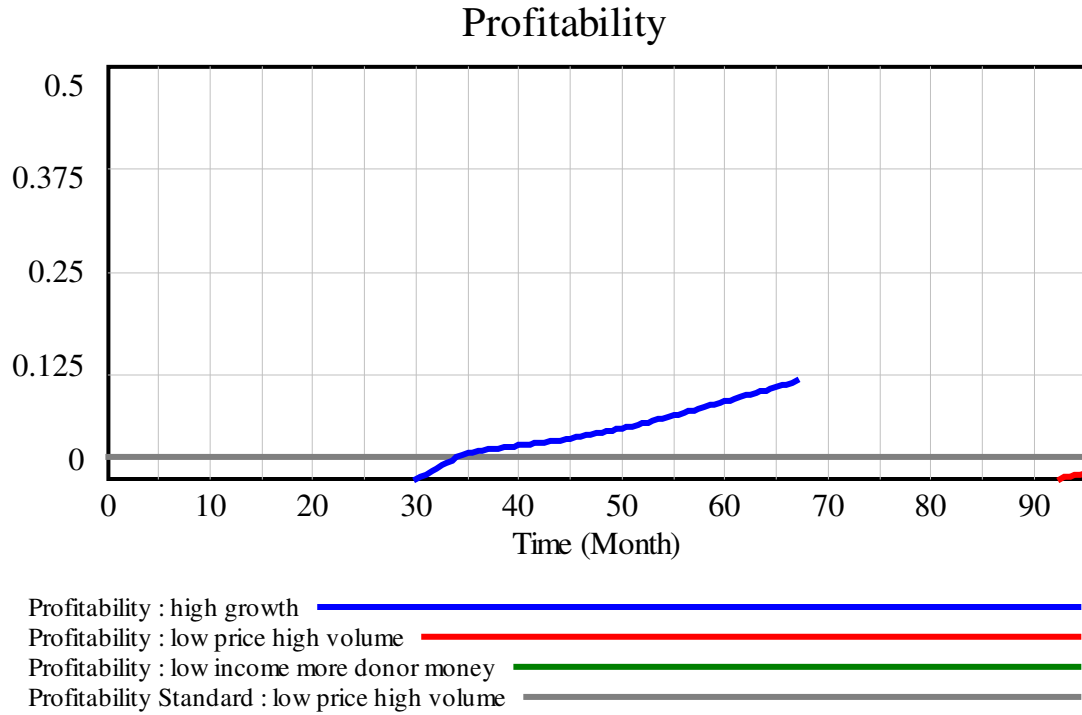


Figure 10: Profitability with High Growth Strategy (Until Funds Are Exhausted)

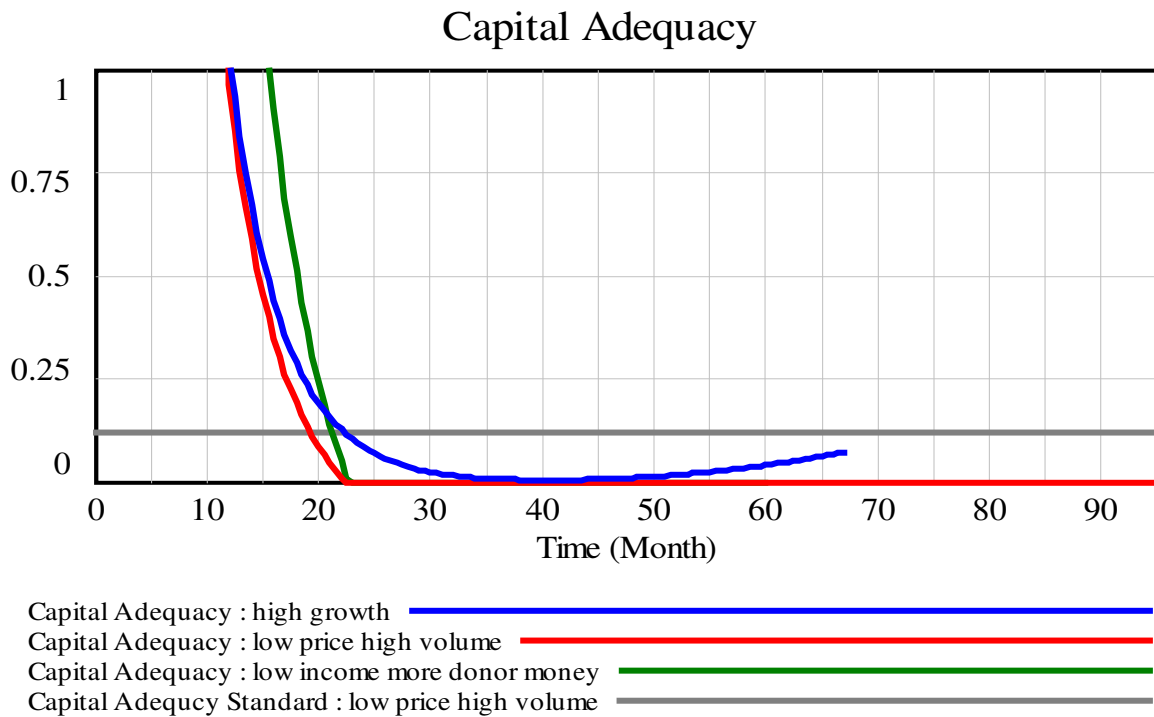


Figure 11: Capital Adequacy Doesn't Quite Meet Standard in High Growth Strategy

### ***B. A Growth Strategy That Works (But is Vulnerable to Economic Shocks)***

What will it take to make this sort of growth strategy viable? Figures 12 through 14 compare this last strategy in the previous set (*high growth*--again represented by the blue line) to results from two other simulations.

- In this modified growth strategy called ***medium growth***, after breaking even in month 30, the MFI enjoys the benefits of its profitability for 22 months before starting its period of accelerated growth. It waits until month 52 when its equity is approaching the standard that external funders require before resuming the branch network expansion. Then it is so confident of its ability to grow that it adds two branches per month after drawing on commercial banks, the bond market, and investors to supplement its funds available for lending.
- In ***medium growth with crisis***, the same strategy as the previous one is implemented, but there is a set of economic shocks that have a number of adverse effects on the growing MFI. The principal one is that borrowers have greater difficulty repaying loans and the default rate doubles for a period of time. New applications also drop off because people are reluctant to take on new obligations in a time of economic turmoil. The MFI cannot get external funding because its default rate is too high, but it continues to be profitable and decides to “go it alone” and pursue the ambitious growth path using only the limited donor funding (\$3 million) and internally generated funds.

As shown in Figure 12, the more moderate growth strategy (called *medium growth* and indicated by the green line) produces a substantial increase in the number of borrowers through the end of the simulation, reaching almost 40,000 borrowers and continuing to grow at the end. Waiting to resume growth until month 52 leaves the MFI with only about half as many borrowers as in the previous strategy (again represented by the blue line), at the point in month 66 where that strategy caused the MFI to run out of money. However, by waiting until month 52 to resume growth, the MFI has increased its equity to the point where it can draw on additional funds from other outside sources and can support a significant rate of growth through the end of the simulation. The green line in Figure 13 shows that capital adequacy exceeds the standard by a substantial amount and the MFI is able to remain above this standard even though it is adding two branches per month to its network. Though its profitability later falls below the standard because of the rapid rate of growth, as shown in Figure 14, the MFI has obtained enough financing from those external sources to be able to grow unhindered by funding limitations.

Can this new strategy be expected to perform well under all circumstances? It is very dependent on external sources of financing and on meeting the criteria by which those sources measure an MFI's performance. The third simulation in this set shows the effect of an economic crisis on what, in good circumstances, is a very effective strategy. In the graph of total borrowers in Figure 12, their number in this simulation, indicated by the red line grows at a substantial rate through about month 80 when the MFI runs out of funding. This is the result of trying to maintain a two branch per month expansion relying on internally generated funds. The MFI had counted on external funding beyond those it got earlier from donors, but could not draw on those funds because the economic crises kept many borrowers from repaying their loans and its default

rate, shown by the red line in Figure 15, went way above the acceptable standard. Lower profitability during the crises, of course, left the MFI with much lower equity and less able to sustain the higher growth rate.

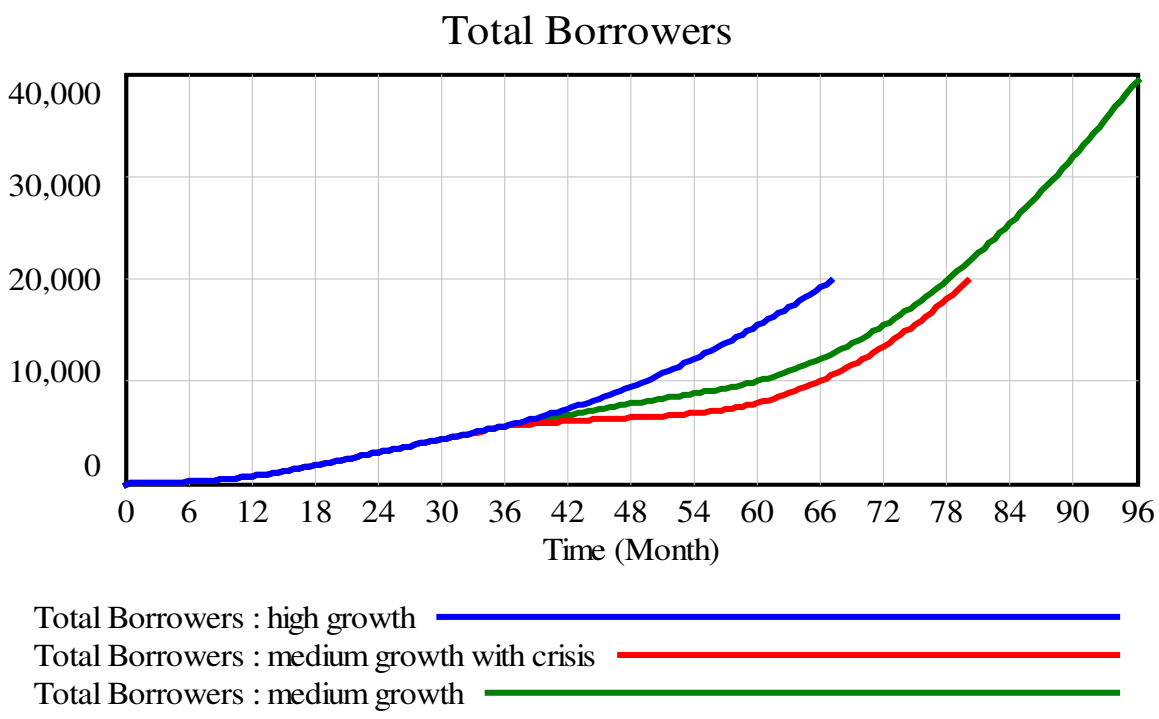


Figure 12: Total Borrowers in Three Scenarios with One Successful Growth Strategy

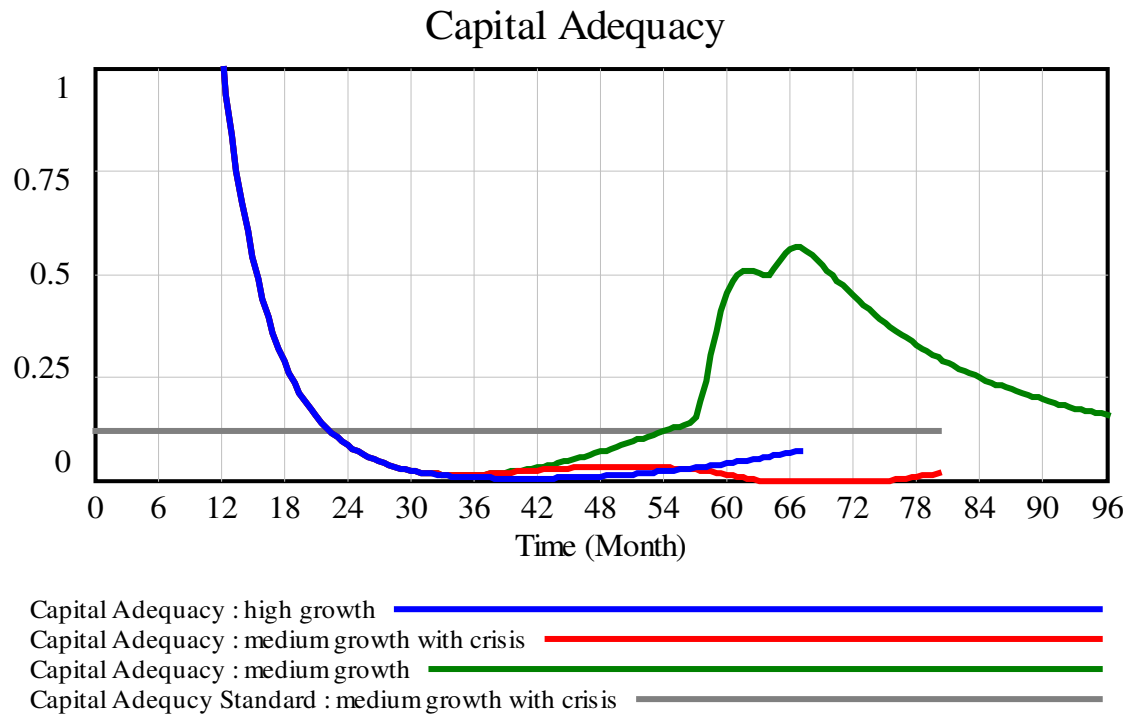


Figure 13: Growth Strategy Achieves Sufficient Level of Capital Adequacy

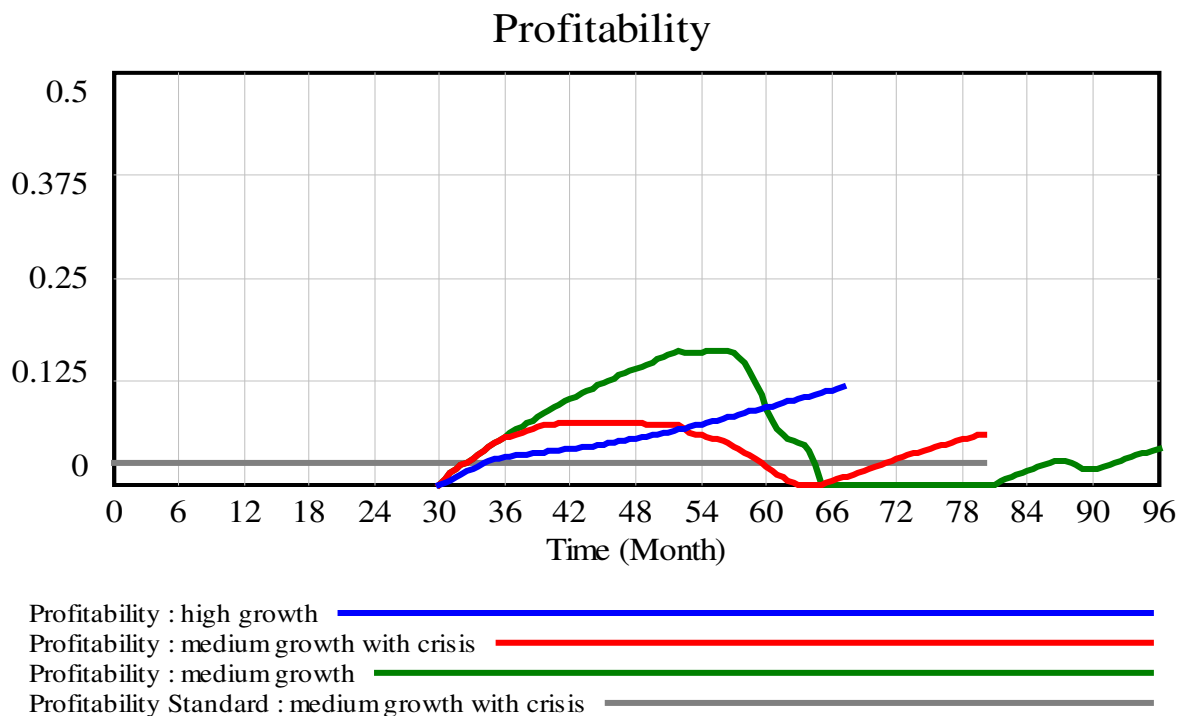


Figure 14: Profitability in Three Scenarios with One Successful Growth Strategy

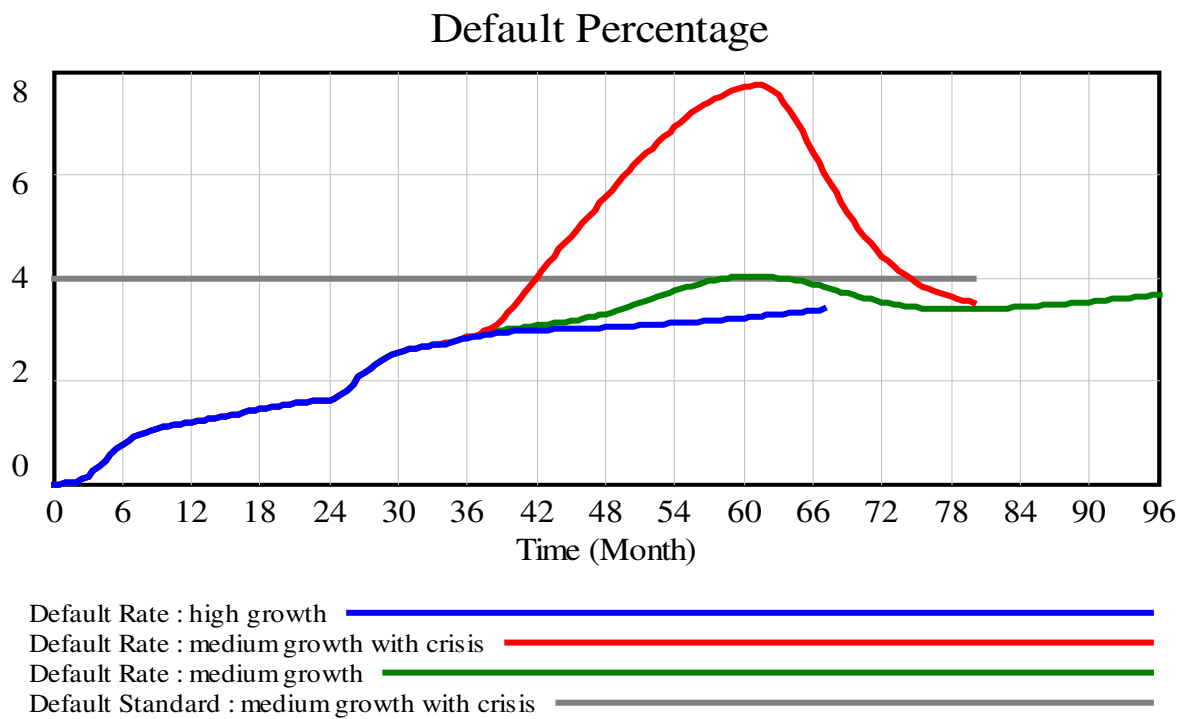


Figure 15: Defaults Including “Bulge” Due to Economic Crises

### *C. Different Ways to Succeed*

Are there other growth strategies that are less sensitive to these kinds of economic shock? The next set of simulations examines two additional growth strategies:

- One called *modest growth, high profit* that is similar to the medium growth strategy that proved to be successful earlier, but that is less dependent on external conditions. It simply adds the 12 branches during the first 12 months and stays with that number for the remainder of the simulation. It draws funds from donors (\$3 million at 20 months), but does not rely on any other outside funding.
- Another simulation, *lower income sustainable*, featuring a growth strategy focused on lower income people with products offered by the MFI that are appropriately designed for that target population. In that strategy, the size of the loans is cut in half, the term is doubled, and interest rate is doubled as well to make the loans both profitable and affordable by the people in the lower income groups the MFI is serving. Branches are added once the MFI becomes profitable. This strategy also relies only on donor funding, but has access to a larger amount, \$5 million, because of its emphasis on borrowers with lower incomes.
- An additional simulation, *lower income sustainable strategy with crisis*, that “torture tests” this strategy focused on lower income people by subjecting it to the same set of economic shocks used earlier.

Figures 16 and 17 compare results from these strategies to the one shown in the previous set called *medium growth* (again represented by the green line) and indicate that these can be very viable strategies. In Figure 16, the number of borrowers in the new simulation called *modest growth, high profit* (the gray line) is considerably less than the number achieved in the earlier simulation labeled medium growth. One would expect this, given the limitations on the size of the branch network imposed by this strategy. However, in Figures 17 and 18, it is apparent that this modest growth strategy can produce significant profitability and build equity for the MFI that far exceed that achieved by the previously most successful strategy by the end of the simulation. Unlike the previous simulation that needed extensive funding from an array of outside sources, the “modest growth, high profit” strategy relies only on donor funding. This makes the strategy less vulnerable to economic shocks that may cause external funders other than donors to be less likely to provide capital.

The strategy focused on lower income people also proves to be very successful, albeit on a smaller scale than the medium growth strategy. As shown by the red line in Figure 16, the number of borrowers achieved with this strategy (*lower income sustainable*) is smaller, but is still significant. What is more striking is the profitability, shown by the red line in Figure 17 compared to the green line. More modest growth and a poorer target population can still yield a very viable, profitable result if the strategy and the products offered by the MFI are designed properly. Furthermore, as indicated by the blue line in both graphs (*lower income sustainable strategy with crisis*), this strategy is a resilient one that can remain viable even in the face of serious economic shocks. The number of borrowers and profitability are naturally a bit smaller

as a result of the shock and trail those numbers in the simulation without the shock, but the results show that the MFI can still achieve significant profitability by the end of the simulation.

### Total Borrowers

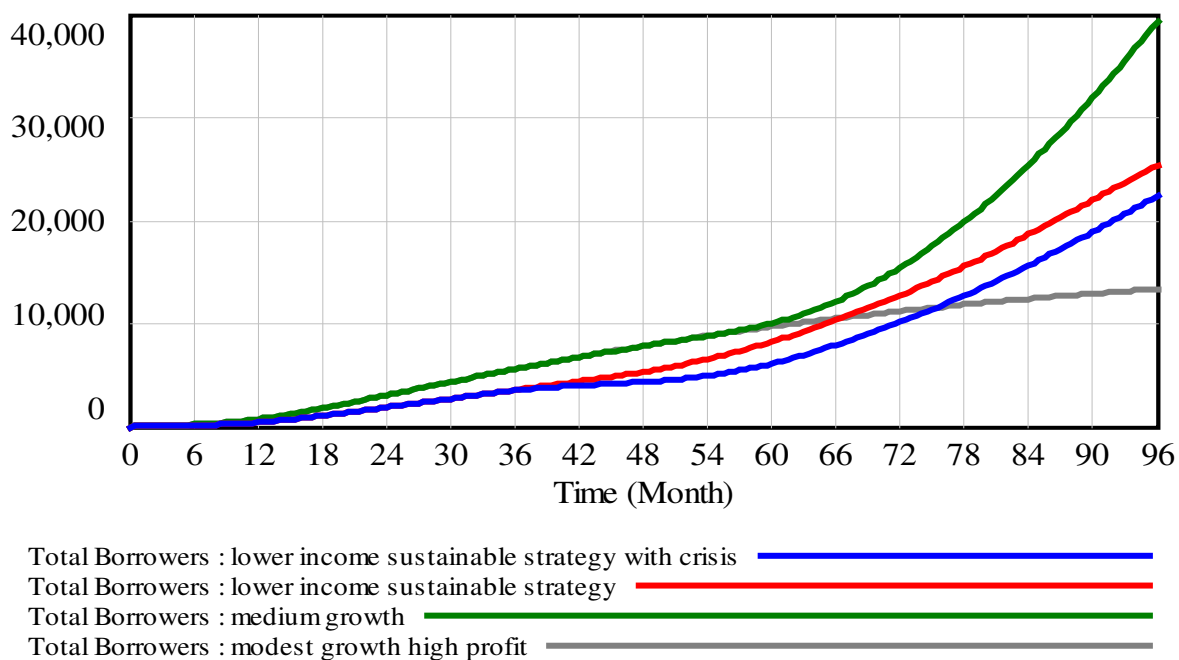


Figure 16: Total Borrowers with (Successful) Alternative Growth Strategies

### Profitability

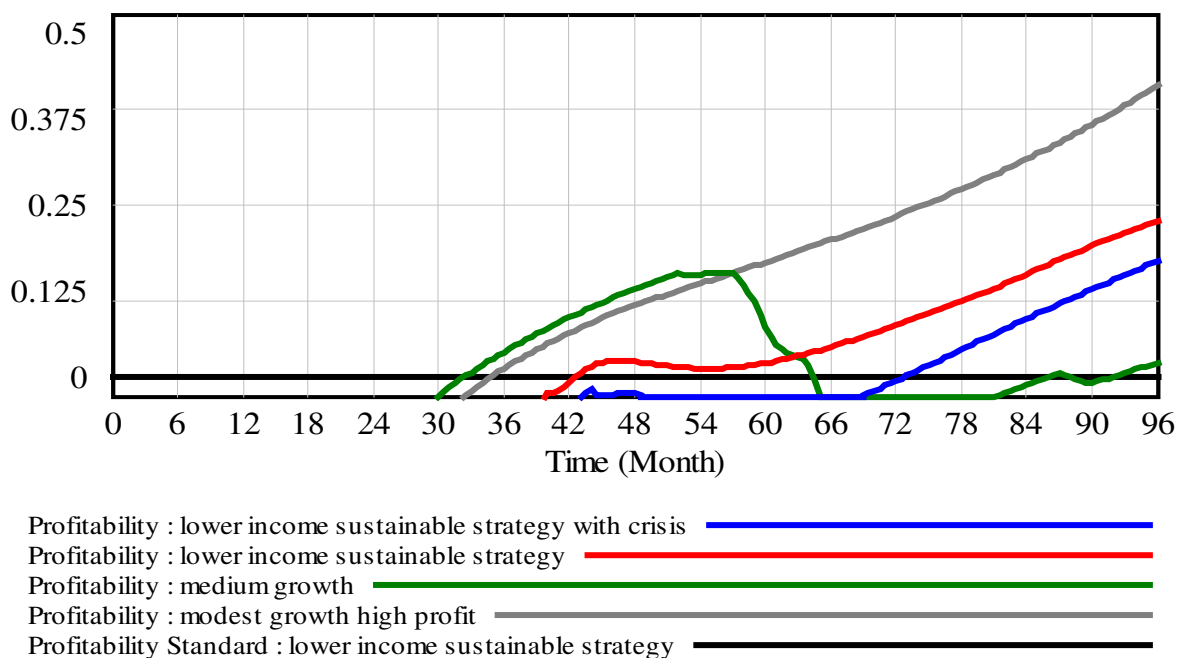


Figure 17: Profitability with (Successful) Alternative Growth Strategies

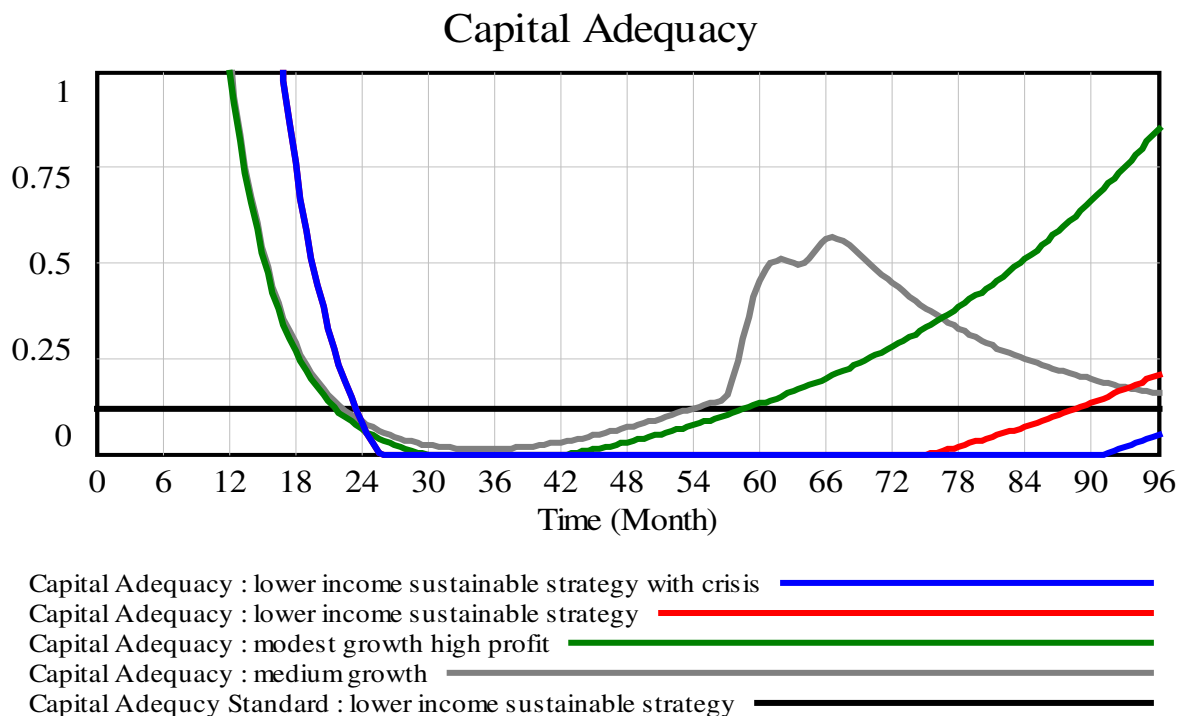


Figure 18: Capital Adequacy with (Successful) Alternative Growth Strategies

Table 2 at the end of the paper provides an overview of the strategies discussed and the results they produced. As indicated earlier, these simulations are meant to be illustrative and represent only a small fraction of the variations that can be tried with the MFI simulator. Users can experiment with many different combinations of target population, product design, staffing and branch expansion, and funding sources. There are, for example, many options involving taking savings deposits and using them to fund loans that add to the array of possibilities.

### Experience with SymBanc™ and Future Development

The principal use of the simulator so far occurred in the “Financial Institutions for Private Enterprise Development (FIPED)” course described earlier. The simulator was used by teams of FIPED students in several exercises and was generally found to be a helpful aid for thinking about MFI strategy and exploring the strategic options open to MFI’s. Use of the simulator by students in that course, mostly career people already working in or with MFI’s, also provided a number of ideas about how to improve it for future use.

Suggestions by FIPED course participants have already led to several improvements in the interface that give users more information that they need to support decision making and make the simulator more straightforward to use. A capability was also added that enables users to output detailed results to an Excel spreadsheet. Exercises with the simulator also were a good test of the model and revealed some behavior that was potentially unrealistic such as profitable operation with high cost loans that would normally be rejected by potential borrowers in the real world. Adjustments to certain parameters such as productivity of loan officers and savings

account productivity by branches were also made as a result of the FIPED experience. Copies of the simulator have also been shared with the staffs of several international development agencies who are in the process of evaluating it.

As indicated earlier, future versions of the simulator will include other types of financial products such as lending to small and medium enterprises with lines of credit and consumer loans to civil servants and other salaried employees. Future versions will also allow the simulated MFI to offer trade and agricultural loans simultaneously rather than separately as they are now. Additional enhancements that are planned include:

- Expanded set of loan features and enabling loans at different stages to have different characteristics,
- Adding other types of savings products such as credit union style accounts,
- The ability to serve urban or rural markets separately or together,
- Options to consider different forms of organization and governance,
- A number of enhancements to the interface including the possibility of displaying results on maps to indicate performance by sub-regions,
- A greater variety of market and regulatory environments,
- More elaborate reflection of the country's macroeconomic environment and its effects on the MFI and its customers,
- Scripted scenarios including those that start with an existing MFI (rather than a startup situation) moving from a subsidized to self-sustaining operation,
- A multi-user version for networked and Internet use,
- Eventually creating a hybrid model in which certain agent-based features are added to reflect behavior of individual applicants and borrowers.

## References

- CGAP (Consultative Group to Assist the Poor) web site at [www.cgap.org](http://www.cgap.org) provides an excellent source of information and a "gateway" to other sources.
- Daley-Harris, S. (2004). State of the Microcredit Summit Campaign Report 2004. Washington, D.C., *Microcredit Summit*: 2-36.
- Hashemi, S., S. R. Schuler, et al. (1996). Rural Credit Programs and Women's Empowerment in Bangladesh. *World Development* 24(4): 635-653.
- Hirsch, GB, Giuliano, V, Winnig, M, (2003). A Strategy Simulator for Newspapers: Overcoming the "Silos" to Do Whole-Enterprise Planning, *Proceedings of the International Conference of the System Dynamics Society*, New York City, New York
- Hirsch GB, Immediato CS, (1998). Design of Simulators to Enhance Learning: Examples from a Health Care Microworld. *Proceedings of the International Conference of the System Dynamics Society*, Quebec City, Quebec.
- Ledgerwood, J, (2001) *Microfinance Handbook: An Institutional and Financial Perspective (Sustainable Banking with the Poor)* Washington, DC, The World Bank



Pitt, M. S. K. (1998). "The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter?" *Journal of Political Economy* 106(5): 958-996.

Reardon, T., K. Stamoulis, et al. (1998). "Rural Nonfarm Income in Developing Countries" *The State of Food and Agriculture\_1998*. Rome, Food and Agricultural Organization of the United Nations.

Strategy	Implementation	Results
<b>A. Common Mistakes an MFI Might Make</b>		
1. Low Income, More Donor Money	Target low-income population to get more donor money, but insist that borrowers take large loans in order to grow portfolio rapidly	Attracts only limited number of borrowers and experiences high default rate among those who do borrow; runs out of cash after 60 months.
2. Low Price, High Volume	Grow borrower population rapidly by charging low interest rate and going after entire market, not just low-income borrowers	Attracts greater number of borrowers, but cannot meet donors' profitability standard because of low interest rate.
3. High Growth	Charge competitive rate to grow gradually; build on initial success by drawing additional funds from donors and pursuing rapid branch expansion	Rapid growth in borrowers, low default rate, and high profitability produce early breakeven, but accelerated branch expansion keeps MFI from building equity required by donors and it runs out of cash.
<b>B. Growth Strategy That Works, but is Vulnerable</b>		
4. Medium Growth	Same strategy as in 3, but delay branch expansion until equity meets donors' requirements	Delaying branch expansion slows early growth in borrowers, but permits MFI to build equity, meet capital adequacy standard, and draw on additional donor funds.
5. Medium Growth with Crisis	Same strategy as in 4, but simulated economic shocks cause new applications to drop and default rates to increase	Economic shocks produce high default rate that makes additional donor funds unavailable; MFI runs out of cash.

Table 2: Overview of Results

Strategy	Implementation	Results
<i>C. Different Ways to Succeed</i>		
6. Modest Growth, High Profit	Limited branch expansion allows less reliance on external funding.	Limited branch network attracts fewer borrowers, but enables MFI to be highly profitable and build greater equity.
7. Lower Income Sustainable	Focus on lower-income population with products (smaller loan sizes, longer terms, and higher interest rates) that help ensure repayment and higher profitability.	Properly designed products enable focus on lower-income groups to be profitable, even with slower growth than in medium growth strategy (4).
8. Lower Income Sustainable Strategy with Crisis	Same strategy as in 7, with simulated economic shocks.	Well-designed products for lower-income group enable MFI to survive economic shocks and become profitable again afterwards.

Table 2 (continued): Overview of Results