

Financial Analysis Programs for Project Work



Economic Evaluation of Education Projects

Agency for International Development

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ECONOMIC EVALUATION OF EDUCATION PROJECTS

**Financial Analysis Programs
for Project Work**

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FINANCIAL ANALYSIS PROGRAMS FOR PROJECT WORK

Introduction

The Financial Programs software offers a menu of five programs, easy to use and helpful in the economic and financial analysis of projects.

The first two programs allow you to enter cost and benefit data. For the first program you enter a single stream of data. This requires you to figure the net value, or the difference between the costs and the benefits for each year of the project. In the second program you enter the costs and the benefits separately, creating a double stream of costs and benefits.

If you keep the costs and benefits separate, you can inflate costs uniformly by any factor, deflate your expected benefits, do both, or modify single-year values using the sensitivity analysis program. You can then calculate internal rate of return (IRR) on the modified data files in addition to calculating IRR on the original data file. If you plan to perform sensitivity analysis, you must enter your data in a double stream, or an RR2 file, because you cannot modify single stream data files for sensitivity analysis.

Using the single stream format is faster, but it does not allow you to perform sensitivity analysis and requires special carefulness about signs in negative quantities. With the single stream format, however, you can find the present value of future costs and benefits. Present value can only be calculated on single stream or RRI files.

The last program is internal rate of return. This program reads RRI, RR2, and RR2 files created with the sensitivity analysis program. If however, there were RRI and RR2 files with the same name, the IRR program would read the RRI file.

Review the assumptions on the following page then begin Exercise 1 by reading the background information. You will be instructed when to turn to the computer software.

Basic Assumptions

These instructions to the Financial Programs software assume that participants are familiar with initial operations and keyboard operations. Not required, but useful, is knowledge of a few commands in BASIC. Let's review these items.

(a) Initial Operations includes such things as:

- (i) how to turn on/off the machine, the monitor, and the printer,
- (ii) how to insert diskettes in the disk drive and the meaning of A> or B> prompts (described in Annex A), and
- (iii) how to restart (ALT-CTRL-DEL) the system or stop (CTRL-BREAK) a program.

(b) Keyboard Operation. See the instruction manual for your particular make of computer.

(c) Advantageous Commands in BASIC

If you need help formatting or copying a diskette use your BASIC manual. The manual will also give you the commands for such things as listing the directory and erasing files.

EXERCISE 1

Background

The Ministry of Education in Panista has expressed concern that so many secondary students in Chico Province are dropping out of school. The problem is especially pronounced at the 11th grade level when 30 percent of the students left school last year alone. Reasons school leavers are giving for their return to the fields are (1) not enough teachers to give personalized instruction, (2) crowded schools, and (3) a lack of courses that are relevant to the students' farm work.

The Economic Planning Division of the government has determined that a citizen with a 12th grade education can earn approximately \$1,000 a year. One with only an 11th grade education can earn about \$550 per year, however. In measuring the benefits, earnings power is a proxy for value of worker productivity. Thus, for each student who leaves school in the 11th grade, the country loses \$450 in worker productivity.

Options

Panista is suffering from a lack of skilled manpower and thus could absorb additional graduates in more productive employment. The Ministry of Education has formulated three economically feasible approaches to enrolling students in secondary school through graduation. They are:

- a. investing in the four existing schools by offering more agriculture and technical training and one teacher per school;
- b. building and staffing a fifth school within the Province to cut down class sizes and offer higher teacher/student ratios, while keeping the same curriculum; or
- c. setting up a separate agricultural/technical school in an abandoned warehouse and staffing it with recent graduates of the teacher training college who need experience in the classroom.

Task

Although funds may be available from UNDP, USAID, and other sources for the project, your job as economic advisor to the Ministry of Education is to determine which option will result in the highest internal rate of return (IRR) over a ten-year period. The Financial Programs software package will help you use the cost and benefit data to calculate IRR. Instructions on how to use the software package specifically for Option follow the data for Option A. Refer back to the instructions when calculating IRR for Options B and C.

Option A

This option involves revising the curriculum to include courses in agricultural economics and general business. The revisions will force the schools to purchase new texts and additional supplies. While all four schools will benefit from a single curriculum revision, each school will require an additional teacher for the new courses. The following indicates the costs of the project.

Costs

<u>Year 1</u>	
Curriculum revision	\$50,000
4 extra teachers @\$1,000 each	4,000
Texts and supplies	<u>10,000</u>
TOTAL	\$64,000

<u>Year 2</u>	
Teachers	\$4,000
Supplies	<u>1,000</u>
TOTAL	\$5,000

Years 3 - 10

The operating cost for each of the remaining years is \$5,000 per year.

Benefits

For each additional graduate who completes the secondary schools in the Providence of Chico, Panista will realize an additional \$450 of worker productivity. (A secondary school graduate earns \$1,000, which is \$450 more than a non-graduate.) The following indicates the estimated number of additional students who will graduate from the secondary schools in Chico.

Benefits, cont.

<u>Year 1</u>	
25 additional graduates	
@ \$450 additional	
personal income =	\$11,250
<u>Year 2</u>	
30 @ \$450 =	13,500
<u>Year 3</u>	
40 @ \$450 =	18,000
<u>Year 4</u>	
40 @ \$450 =	18,000
<u>Years 5 - 10</u>	
50/year @ \$450 =	22,500

Using the following instructions, input these figures into a double stream file and then use the internal rate of return program to calculate which option will realize the highest return.

Instructions

To use the Financial Programs software, you must first copy a BASIC interpreter onto your Financial Programs diskette. (See Annex A for instructions on inserting diskettes and Annex B for copy instructions.) With BASIC on the same diskette as Financial Programs, insert the diskette in drive A.

After the A>, type the following:

A>basic fmenu and press the Enter key

If you are using an IBM, type basica fmenu, ibmbasic fmenu, or ibmbasca fmenu. This will depend upon which BASIC program you copied from your DOS diskette.

On the screen will appear the "Menu of Financial Programs." It will ask you which program you wish to operate.

```
*****
                        MENU OF FINANCIAL PROGRAMS
                        by Jose Dominguez-Urosa
*****

1.  ENTER a Single (Net) Stream of Costs (-) and Benefits (+).
    Don't Forget the Negative Sign When Applicable!
2.  ENTER a Double Stream of Costs and Benefits, and File.
3.  READ and MODIFY a File with separate Costs and Benefits (RR2),
    to Perform Sensitivity Analysis.
4.  READ and Find the PRESENT VALUE of a Single Stream
    Data File (RR1) -from Programs 1 or 2.
5.  Read and Find the INTERNAL RATE OF RETURN of either
    a Single or Double Stream Data File (RR1 or RR2).
6.  EXIT TO MBASIC.

TYPE THE NUMBER PROCEEDING THE PROGRAM YOU WISH TO OPERATE

                        WHICH ONE?
```

For this exercise you will use the double stream format. Creating a double stream of costs and benefits will allow you to perform sensitivity analyses on the data. Therefore, after the question **WHICH ONE?**, type the number 2, but do not press the Enter key, to create a double stream file. (If you accidentally press Enter, year 1 will be bypassed. If this happens, restart the program by pressing CTRL, ALT, and DEL at the same time.

This will return you to the A>.) In a few seconds, the following will appear:

```
*****
CREATE DATA FILE FOR IRR

(Double Stream Format)
by Jose Dominguez-Urosa          Pls, ENTER
*****

E to END data entry and
R to Repeat any amount.

Year      Costs      My Reading
1         ?
```

You will first enter the costs from page 4 for each year of Option A. Using the number keys on the top of the keyboard. Do not use dollar signs, commas, or decimal points in your numbers. For example, if you want to enter \$64,000.00, simply type **64000**. After pressing **Enter**, 64000 would be converted to -64000 ("My Reading") since it is a cost.

If you want to enter the same number for several years, type **r** rather than entering the same number several times. If the costs are \$5,000 for years two through ten, type **5000** for year 2 and **Enter**. On year 3 you would repeat the number by typing **r** and pressing **Enter**. On the screen would appear the question "OK, I'll REPEAT the last entry (-5000) from Year 3 to Which Year?" In this case, you would type **10** and press **Enter**.

When you have entered your final number, type **e** after the next year. For example, if your last year is 10, you would type an **e** and **Enter** after year 11.

After you enter all the cost data, the following information should be on the screen:

```
*****
CREATE DATA FILE FOR IRR

(Double Stream Format)
by Jose Dominguez-Urosa          Pls, ENTER
*****

E to END data entry and
R to Repeat any amount.

Year      Costs      My Reading
1         ? 64000      -64000
2         ? 5000       -5000
3         ? r
OK , I'll REPEAT the last entry (-5000)
from Year 3 to Which Year? ? 10
Done; Please continue...
11        ? e
```

You will then enter the benefit data from page 5:

```
*****
CREATE DATE FILE FOR IRR

(Double Stream Format)
by Jose Dominguez-Urosa
*****
```

PLs, ENTER

E to END data entry and
R to Repeat any amount.

Year	Costs	Benefits
1	-64000	? 11250
2	-5000	? 13500
3	-5000	? 18000
4	-5000	? 18000
5	-5000	? 22500
6	-5000	? r

OK, I'll REPEAT the last entry (22500)
from Year 6 to Which Year ? 10
Done; Please continue...
11 0 ? e

DATA FILE NAME? setA

Press space bar to continue

When you have finished entering the benefit data you must enter the name of the file. Any name or number up to 8 characters long is acceptable. If you plan to conduct a sensitivity analysis on the data, do not use a file name with more than six characters. If you later create a file with the same name, any previous file with that exact name would be erased. (This is useful to remember should you enter the data incorrectly--if you need to enter it again, the previous file with the same name will be erased.) For this example, use the file name "setA" for the Option A data. Type seta and Enter to store the file on the diskette.

By pressing the space bar you will return to the main menu. Program 5 will allow you to find the rate of return for Option A. Type 5, but do not press Enter. The following will appear on the screen:

```
*****
INTERNAL RATE OF RETURN

program written by
Jose Dominguez-Urosa
*****
```

DATA FILE NAME?

Type the data file name **seta** and press **Enter**. The following will appear on the screen for only a short time. If you want to slow it down long enough to look at the information, quickly press **Ctrl** and **Num Lock**.

```
*****
INTERNAL RATE OF RETURN

program written by
Jose Dominguez-Urosa
*****
```

DISCOUNTING...

```
DATA FILE NAME? setA
1 -64000 11250          2 -5000 13500          3 -5000 18000
4 -5000 18000          5 -5000 22500          6 -5000 22500
7 -5000 22500          8 -5000 22500          9 -5000 22500
10 -5000 22500
```

```
FILE HAS DATA FOR 10 YEARS
10 PRODUCE INCOME AND 10 CASH OUTLAYS
```

The next thing that will appear on the screen is:

```
*****
INTERNAL RATE OF RETURN

program written by
Jose Dominguez-Urosa
*****
```

```
THESE ARE THE PRESENT VALUES... DISCOUNTING...
1.00 86750.00          1.36 -18200.64
1.01 79465.43          1.74 -36860.28
1.10 32751.17          2.72 -46716.37
1.19 7327.00           6.06 -50917.62
CHOSEN FOR INTERP 1.187153          1.361796 [PV1= 7326.996 PV2=
-18200.64 ]
VERIFYING...
CHOSEN FOR INTERP 1.219899          1.230814 [PV1= 650.2266 PV2=
-1323.695 ]
THESE ARE FINAL VALUES: 1.228085 [ 650.2266 ]
AND 1.230814 [ -1323.695 ]
```

THE INTERNAL RATE OF RETURN IS 22.90 % (-/+ .5 %)

A:setA.RR2

Press space bar to continue

The final line tells you that the yield on Option A is 22.90 percent. An internal rate of return of 22.90 percent simply means that this investment will generate a return on capital that would be equivalent to compounded interest of 22.90 percent per year.

Follow the same steps for Option B (give it the file name "setB") and Option C (setC), first creating data files and then finding the internal rate of return.

If at any time you have an unexpected message on the screen, refer to Annex C.

Option B

Costs

<u>Year 1</u>	
Build and equip a fifth small school	\$200,000
20 staff @ \$1,000	20,000
2 administrators @ 1,300	2,600
Supplies and texts	<u>15,000</u>
TOTAL	\$237,600

<u>Year 2</u>	
Staff	\$20,000
Administrators	2,600
Supplies	<u>6,000</u>
TOTAL	\$28,600

Year 3 - 10

The operating cost for each of the remaining years is \$28,600 per year.

Benefits

For each student that graduates from the new school, Panista will realize an additional \$450 of worker productivity. The following indicates the number of students who will graduate from the fifth school.

Year 1
100 graduates @ \$450 = \$45,000

Years 2 - 4
150 @ \$450 = _____

Years 5 - 6
175 @ \$450 = _____

Years 7 - 10
200 @ \$450 = _____

Option C

Costs

Year 1
Refurbish old warehouse \$75,000
10 staff @ \$800 8,000
Supplies and texts 12,000
TOTAL \$95,000

Year 2
Staff \$8,000
Supplies 2,000
TOTAL \$10,000

Years 3 - 10
The operating cost for each of the remaining years is \$10,000 per year.

Benefits

For each student that graduates from the school, Panista will realize an additional \$450 of worker productivity. The following indicates the number of students who will graduate from the school.

Years 1 - 2
40 graduates @ \$450 = \$18,000

Years 3 - 4
50 @ \$450 = _____

Year 5
75 @ \$450 = _____

Years 6 -10
100 @ \$450 = _____

Questions, Exercise 1

1. What is the internal rate of return for each of the options:

Option A = 22.90 percent

Option B = _____

Option C = _____

2. Which project option would you select based on the internal rate of return figures? _____

Since none of the three rates of return are significantly different than the others, you should not depend upon only the IRR to make your selection of the best option. From this point you should try a couple other methods. One thing you could try, using this software package, is a sensitivity analysis.

Sensitivity Analysis

In some projects, it is convenient to retain costs and benefits as two separate streams, given that the factors affecting your expenses are different from those affecting the benefits. In this exercise you kept the costs and benefits separate by entering them in a double stream. (In Exercise 2 you will use Program 1 in which you will enter a single stream of net costs or benefits.)

A common practice, after having found a project with an acceptable rate of return, is to modify the costs or the benefits for a single year, or uniformly throughout the years, to see if the project continues to have an acceptable rate of return. This is called "sensitivity analysis."

To facilitate this type of analysis, the main menu of the Financial Programs software package includes Program 3, "Read and modify a file with separate costs and benefits (RR2), to perform sensitivity analysis." Program 3 reads from a data file created by Program 2 and allows you to modify the data as many times as you want, without destroying or altering your original data. Everytime it stores a new variation of your data, the computer adds a digit, e.g., 1, 2, 3, etc., to your original file name. For example, the name of the file for your first sensitivity analysis would be "SetA 1.RR2" and the second would be "SetA 2.RR2". In that way you can conduct the internal rate of return calculation on each variation of the same data.

Suppose you are not sure that you can revise the curriculum in Option A for \$50,000. If it costs more, will Option A still have the highest rate of return? A sensitivity analysis will help you answer this question.

Instructions

From the main menu choose Program 3 and the following should appear:

```
*****  
SENSITIVITY ANALYSIS PROGRAM  
  
program written by  
Jose Dominguez-Urosa  
*****
```

DATA FILE NAME?

Then type seta and Enter.

```
*****  
SENSITIVITY ANALYSIS PROGRAM  
  
program written by  
Jose Dominguez-Urosa  
*****
```

```
DATA FILE NAME? seta  
FILE HAS DATA FOR 10 YEARS  
10 ARE POSITIVE AND 10 ARE NEGATIVE  
The Present Value at 0% is 86750
```

Since you will change the costs for year 1, select option 4, but do not enter. If you want the estimate for the cost of the curriculum revision to be \$60,000 rather than \$50,000, the total cost for year 1 will be \$74,000. For this example the benefits will remain \$11,250 for year 1. After the question "Enter the year to be changed?" type 1 and Enter. The following will appear:

 SENSITIVITY ANALYSIS PROGRAM

program written by
 Jose Dominguez-Urosa

1	-64000.00	11250.00	2	-5000.00	13500.00	3	-5000.00	18000.00
4	-5000.00	18000.00	5	-5000.00	22500.00	6	-5000.00	22500.00
7	-5000.00	22500.00	8	-5000.00	22500.00	9	-5000.00	22500.00
10	-5000.00	22500.00						

WOULD YOU LIKE

1. TO HAVE A PRINTED COPY OF YOUR SET OF DATA?
 2. TO HAVE ALL COSTS MULTIPLIED BY A FACTOR? -e.g. 1.15
 3. TO HAVE ALL BENEFITS MULTIPLIED BY A FACTOR? -e.g. .95
 4. TO CHANGE COSTS AND/OR BENEFITS FOR ANY SINGLE YEAR?
 5. TO SAVE YOUR LAST SET OF DATA?
 6. TO EXIT THE PROGRAM, RETURNING TO THE MAIN MENU.
- WHICH ONE? 4

ENTER THE YEAR TO BE CHANGED ? 1
 OLD Costs and Benefits ARE -64000, 11250
 ENTER THE NEW VALUES -i.e. -5000,354

Type the new cost and benefit values, -74000, 11250 and Enter.

 SENSITIVITY ANALYSIS PROGRAM

program written by
 Jose Dominguez-Urosa

1	-64000.00	11250.00	2	-5000.00	13500.00	3	-5000.00	18000.00
4	-5000.00	18000.00	5	-5000.00	22500.00	6	-5000.00	22500.00
7	-5000.00	22500.00	8	-5000.00	22500.00	9	-5000.00	22500.00
10	-5000.00	22500.00						

WOULD YOU LIKE

1. TO HAVE A PRINTED COPY OF YOUR SET OF DATA?
 2. TO HAVE ALL COSTS MULTIPLIED BY A FACTOR? -e.g. 1.15
 3. TO HAVE ALL BENEFITS MULTIPLIED BY A FACTOR? -e.g. .95
 4. TO CHANGE COSTS AND/OR BENEFITS FOR ANY SINGLE YEAR?
 5. TO SAVE YOUR LAST SET OF DATA?
 6. TO EXIT THE PROGRAM, RETURNING TO THE MAIN MENU.
- WHICH ONE?

ENTER THE YEAR TO BE CHANGED ? 1
 OLD Costs and Benefits ARE -64000 , 11250
 ENTER THE NEW VALUES -i.e. -5000,354 -74000,11250

To save the modified data, next select option 5, but do not press Enter. This will automatically save your data under the name "setA 1." If you choose to modify it a second time, the file name will be "setA 2." This operation will not affect the data in the "setA" file. After the file has been saved, the following will appear on the screen:

 SENSITIVITY ANALYSIS PROGRAM

program written by
 Jose Dominguez-Urosa

1	-74000.00	11250.00	2	-5000.00	13500.00	3	-5000.00	18000.00
4	-5000.00	18000.00	5	-5000.00	22500.00	6	-5000.00	22500.00
7	-5000.00	22500.00	8	-5000.00	22500.00	9	-5000.00	22500.00
10	-5000.00	22500.00						

WOULD YOU LIKE

1. TO HAVE A PRINTED COPY OF YOUR SET OF DATA?
 2. TO HAVE ALL COSTS MULTIPLIED BY A FACTOR? -e.g. 1.15
 3. TO HAVE ALL BENEFITS MULTIPLIED BY A FACTOR? -e.g. 1.15
 4. TO CHANGE COSTS AND/OR BENEFITS FOR ANY SINGLE YEAR?
 5. TO SAVE YOUR LAST SET OF DATA?
 6. TO EXIT THE PROGRAM, RETURNING TO THE MAIN MENU.
- WHICH ONE? 5

DATA STORED IN seta 1.RR2

Return to the main menu by selecting option 6. Now find the internal rate of return for file "setA 1."

Questions, Exercise 1, cont.

3. What is the the rate of return for Option A when you change the initial costs? _____
4. After the conducting a sensitivity analysis, does Option A still have the highest rate of return? _____
5. Based on your financial analyses to this point, which two options will you recommend to the Ministry of Education? Why?

EXERCISE 2

Background

The southern region of Malgola has, for a number of years, had the lowest productivity of all the regions in the country. The Ministry of Agriculture considers the prime reason for low productivity to be lack of an efficient extension service. The Ministry of Agriculture has tried in the past to remedy this problem. The MOA's main constraint has been the low population density, making the outreach to the farmers difficult. Furthermore, the MOE has never felt justified, because of small amount of students, to build more primary or secondary schools.

Task

The Ministry of Agriculture has asked you to serve on a committee that will propose solutions to the Ministry of Agriculture. After months of meetings, the committee has suggested four options that are financially feasible and will address the problem of low productivity. Your task is to provide an economic analysis of the options, using the value of increased productivity among the target population as the proxy for economic benefit. You will first consider the internal rate of return and later the present value on each of the four potential investments. In the end you will recommend the two options that are the most economically sound.

Use Program 1 to input a single stream of data. To enter a single stream of data you must first calculate the net value (subtract the benefits from the cost) for each year of the project. If the net value is negative, be sure to enter a negative (-) sign before the value.

Option A

Option A is the development of an extension service that will include training programs, a travelling extension agent, and a monthly publication.

Costs

<u>Year 1</u>	
Training facility	\$75,000
Equipment	50,000
Supplies	18,000
U.S. Trainer	32,000
Local Extension Agent	10,000
Local Writer/Editor	<u>5,000</u>
TOTAL	\$210,000

<u>Years 2 - 6</u>	
Maintenance	\$ 5,000/year
Supplies	13,000/year
Trainer	32,000/year
Extension Agent	10,000/year
Writer/Editor	<u>5,000/year</u>
TOTAL	\$65,000/year

Benefits

Year 1

Extension agent will be able to help 25 farmers/year increase their crop production by \$100/year. \$ 2,500

Trainer will be able to train 200 farmers each year, training which will increase their productivity by \$75/year. _____

Publications will help 1,000 farmers each year to directly increase their productivity by \$50. _____

TOTAL _____

Net Benefits (benefits - costs =) _____

Years 2 - 6

Extension agent will be able to help 50 farmers/year increase their crop production by \$100/year. _____

Trainer will be able to train 300 farmers each year, training which will increase their productivity by \$75/year. _____

Publications will help 2,000 farmers each year to directly increase their productivity by \$50. _____

TOTAL _____

Net Benefits (benefits - costs =) _____

Option B

This option will include a resource center in Caba, a small town in the center of the southern region. The center will house instructional materials, an applied research program, and land for a practical laboratory.

Costs

<u>Year 1</u>	
Resource facility	\$105,000
Land	20,000
Equipment	20,000
Supplies	4,000
Magazine and journal subscriptions	1,000
Materials Specialist	15,000
Researcher	<u>25,000</u>

TOTAL \$190,000

<u>Years 2 - 4</u>	
Maintenance	\$10,000
Supplies	3,000
Subscriptions	1,000
Materials Specialist	15,000
Researcher	<u>25,000</u>

TOTAL \$52,000

Benefits

Approximately 1,000 farmers a year will be using the research facility by the end of the fourth year. It is estimated that their productivity will potentially increase by \$250 per year.

<u>Year 1</u>	
400 farmers increased productivity by \$100	\$40,000

Net Benefits (benefits - costs =) _____

<u>Year 2</u>	
500 farmers by \$125	_____

Net Benefits (benefits - costs =) _____

Year 3

800 farmers by \$200 _____

Net Benefits (benefits - costs =) _____

Year 4

1,000 farmers by \$250 _____

Net Benefits (benefits - costs =) _____

Option C

Option C is a technical school that focuses on agricultural techniques and practices. The school will include a dormitory to house the students for their 3-month program.

Costs

Year 1

Classrooms and dormitory	\$550,000
Maintenance and food	60,000
Equipment	50,000
Teachers (2 @ \$25,000)	50,000
Staff (2 @ 15,000)	20,000
Supplies and texts	<u>20,000</u>

TOTAL \$750,000

Years 2 - 8

Maintenance	\$60,000
Teachers	50,000
Staff	20,000
Supplies	<u>20,000</u>

TOTAL \$150,000

Benefits

It is estimated that 40 students from large landholding families can enroll in each 3-month program. Each of the 160 students per year will, with their new skills and knowledge, help increase the productivity of their family farms by \$2,000 per year.

Year 1

80 graduates increased productivity by \$2,000	\$200,000
--	-----------

Net Benefits (benefits - costs =) _____

Years 2 - 8

160 graduates increased
productivity by \$2,000

Net Benefits (benefits - costs =)

Option D

This option will require curriculum revisions in four of the region's secondary schools. While all four schools will benefit from the curriculum revision, each school must hire one additional agricultural science teacher to its faculty.

Costs

Year 1

Curriculum revision	\$40,000
4 extra teachers	20,000
@ \$5,000 each	
Texts and supplies	<u>10,000</u>

TOTAL \$70,000

Years 2 - 4

Teachers	\$20,000
Texts and supplies	<u>10,000</u>

TOTAL \$30,000

Benefits

It is estimated that 600 students can enroll in agricultural science classes in each of the four schools. These students will take new skills and knowledge to their family farms which will help increase crop production by \$600 per year.

Year 1

400 students will help increase their families' productivity by \$80/year	\$32,000
---	----------

Net Benefits (benefits - costs =)

Year 2 - 4

600 students will help increase their families' productivity by \$80/year	
---	--

Net Benefits (benefits - costs =)

Questions, Exercise 2

1. List the rates of return for each option.

Option A _____

Option B _____

Option C _____

Option D _____

2. If you use only the internal rate of return criteria to rank the three projects, which would be the preferred option, or the program that will give the highest return on your investment?

Present Value

Calculating internal rate of return is only one approach to the problem of economic evaluation, however. Another criterion might be to look at the four options from the standpoint of present value. Having another criterion on which to rank the three options is of particular value in this example, where the options have similar IRRs and require investments for different lengths of time.

As we studied in the text, figuring the present value will give you an idea of the present worth payments made over the life of the project. Future payments can be converted to their present worth by using discount factors computed from an appropriate discount rate. Discounting provides a basis for analyzing and comparing future streams of costs and benefits by reducing them to their equivalent present worth. This is another way of ranking the four programs for comparison, and the computer program can be directed to do the calculations very easily.

The only information that must be available, in addition to the data files already created, is the discount rate. Let's assume, for this exercise, that the money to fund this project will be borrowed from the World Bank at an interest rate of 15 percent. Thus, the discount rate--or the opportunity cost of capital--will be 15 percent.* You must type the number as 1.15 and **Enter** and the program will figure present value.

* In theory, "discounting is the reciprocal process to compounding an amount at a fixed rate. The discount rate

The numbers you arrived at are the present dollar values of all the money spent over the life of the projects. The present value amounts will be necessarily lower than the total amounts of all payments. For example, the present value of the investments for Option A will be lower than \$670,000--the total amount spent over the five years. This is true because you must discount the net costs. When you discounted, you did the opposite of compounding interest; by investing your dollars in the project, you incurred an opportunity cost either in the form of potential compounded interest or returns on alternative investments. A positive net present value indicates that the projected return from the investments is greater than the estimated opportunity to invest elsewhere. It also estimates the amount that discounted benefits exceed discounted costs.

Questions, Exercise 2, cont.

3. List the present values for each of the investments:

Option A = _____

Option B = _____

Option C = _____

Option D = _____

4. Based on the basis of present value figures, which would be the two best choices?

corresponds to the interest rate mathematically. However, [when] discounting is used for analyzing projects, the discount rate does not correspond to the interest rate on investment savings. Interest on savings may be much lower than the return rate from a project. The discount rate is selected to correspond to the highest return available from alternative investments. This represents the time value of money as an opportunity cost. The cost of investments not made (the loss of a higher rate of return) figures prominently in the evaluation of projects using a discounted measure of project worth." Peter Delp, et al., Systems Tools for Project Planning (Bloomington, IN: International Development Institute, 1977): 187.

5. Even though Option A has the highest IRR, the present value process reveals that it may not be the preferable option. Based on your IRR findings and present value findings, which two alternatives would you recommend for further consideration? Why?

ANSWERS

Exercise 1

1. Option A = 22.90 percent
Option B = 18.95
Option C = 22.88
2. Based on the internal rates of return, Option A is the preferred option.
3. By altering the initial costs for Option A, the IRR becomes 17.34 percent.
4. No, Option A no longer has the highest rate of return.
5. At this point it would be difficult to select the two best options. Based only on IRR, Option A and B are economically preferable. However, if the cost and benefit data are sensitive to modification, they may no longer be preferred. Before you make recommendations, you should determine the sensitivity of the cost and benefit data and calculate present value.

Exercise 2

1. Option A = 69.72 percent

Option B = 33.44

Option C = 41.07

Option D = 20.09

2. The option with the highest rate of return is Option A.

3. Option A = \$217,856.70

Option B = 70,547.41

Option C = 490,105.00

Option D = 3,098.05

4. Choice #1 = C

Choice #2 = A

5. Options A and C could be recommended on the basis of IRR and present value. They have the two highest IRRs and the highest present values.

ANNEX A INITIAL OPERATIONS

How to Insert Diskettes

1. Remove the diskette from the paper envelope.
2. Open the diskette drive door.
3. Slide the diskette into the drive with the label side up.
4. Make sure the diskette is all the way in, and shut the drive door.

If Your Computer is Off

1. Insert the diskettes in the appropriate drives and close the doors.
2. Switch on the printer, if you have one, the video monitor or TV, and the computer.
3. Wait a moment while the system checks itself out. The length of the pause depends on the amount of memory in your computer; the more memory, the longer the pause.

If Your Computer is On

1. Insert the diskettes in the drives and close the doors.
2. Press and hold the system reset keys simultaneously:
Ctrl + Alt + Del, then release them all.
3. You will see the diskette drive light come on while DOS is being read, and you may hear some clicks and whirs.

Date and Time

1. When the program is loaded and ready, you will see a message similar to this on the screen:

```
Current date is Tue 1-01-1980
Enter new date:
```

You may bypass the date and time option simply by pressing the Enter key. If, however, you wish to enter the date and time, the cursor shows where the first number you type will appear.

2. You use the number keys to set the date:
For example, suppose the current date is August 5, 1982.
You can enter: 8-5-82 or 8/5/82
3. Enter one or two numbers between 1 and 12 for the month.
4. Enter a dash (-) or a slash (/).
5. Enter one or two numbers between 1 and 31 for the day.
6. Enter another dash (-) or slash (/).
7. Enter the last two numbers of the year between 80 and 99.
8. Press the Enter key.

Telling DOS the Time

1. After you have entered the date, DOS displays message similar to this:

```
Current time is 0:01:05.58
Enter new time: _____
```

2. The time displayed is
Hours:Minutes:Seconds.Hundredths of seconds
3. You use the number keys to set the time
4. Enter one or two numbers between 0 and 23 for the hours.

Note: A dash (-) or a slash (/) does not work.

5. Enter one or two numbers between 0 and 59 for the minutes. If you wish to enter the seconds and hundredths of a second, refer to the TIME command in the DOS reference book, but if the

hours and minutes are sufficient, proceed to the next step. DOS
will set the remaining values to zero for you.

Now press the Enter key. A> should appear on the screen.

ANNEX B TRANSFERRING BASIC

The Financial Programs software package was written in the computer language BASIC. Therefore, to read the Financial Programs diskette, you must use BASIC to interpret. However, because of copyright laws, we were unable to include BASIC on the Financial Programs diskette. Before you can use the Financial Programs, you must transfer BASIC onto the Financial Programs diskette. Below are copy instructions for each type of computer, since the specific BASIC program varies among makes of computer. For more details, see your DOS or BASIC instruction manual.

IBM-PC

1. Insert the DOS diskette in drive A and close the door.
2. Insert the Financial Programs diskette in drive B and close the door.
3. Turn on the machine and monitor.
4. You must first find out what version of BASIC is on the DOS diskette. When you see

A>, type

A>dir/w and press the Enter key.

5. In the directory you will see a file named BASICA.COM, IBMBASIC.COM, or IBMBASCA.COM.
6. With an A>, type the name of the BASIC file in the following format:

A>copy basica.com b: and press the Enter key.

7. When the copying is complete, remove DOS from drive A and insert the Financial Programs + BASIC diskette in drive A.

6. After the A>, type

A>basica fmenu, or ibmbasic fmenu, or ibmbasca fmenu, and
Enter

this will load the financial program and a menu will appear on the screen. You are now ready to perform any of the five programs.

Wang

1. Insert the DOS diskette in drive A and close the door.
2. Insert the Financial Programs diskette in drive B and close the door.
3. Turn on the machine and monitor.
4. When you see

A>, type

A>**copy basic.exe b:** and press the Enter key.

5. When the copying is complete, remove DOS from drive A and insert the Financial Programs + BASIC diskette in drive A.
6. On the screen should be:

A>, after it type

A>**basic fmenu**

this will load the financial program and a menu will appear on the screen. You are now ready to perform any of the five program options.

ANNEX C

POSSIBLE ERROR MESSAGES

Occasionally an unexpected message will appear on the screen. The summary below will help you understand the messages and know what to do about them. In any case in which you do not know what to do, simply reset (CTRL + ALT + DEL) and you will return to the A>.

ERROR IN LINE 900--this message appears during Program 5. The program is unable to calculate the IRR on a data file for which there are two files of the same name, i.e., it will not calculate the IRR for Test.RR1 if there is also a file named Test.RR2. You must either delete or rename one of the files.

FILE NOT FOUND--this means that you have tried to open a file that does not exist. Usually this happens when you have misspelled the file name. Check the spelling and retype the file name. If you still have a problem, list the directory (A> dir) for the correct file name spelling or to see whether the file still exists (you may have erased it).

OK--when OK appears on the screen you have exited from the program in which you were working. To return to the program, type run or hit the F2 key.

SORRY, I CAN'T HANDLE THAT--this happens when the costs exceed the benefits to such a large extent that it is impossible for the program to calculate the rate of return. You will either have to lower the costs or increase the benefits.

SYNTAX ERROR--this means that you have entered an illegal command. When this happens, type run and try the command again.

THAT'S IT, NO RR, THANK YOU--this means that you entered positive net benefits for every year. If the benefits always exceed the costs, therefore resulting in positive net benefits, you have no reason to be concerned about the rate of return on your investment.