A PROGRAMMABLE CALCULATOR MODEL FOR ESTIMATING THE ECONOMIC IMPACTS OF GROWTH ON OHIO CITIES AND VILLAGES

I. Introduction

The purpose of this paper is to provide instruction on the use of an economic growth impact model for Ohio cities and villages. This model is designed for use with Texas Instrument's TI-59 programmable calculator and PC-100 series printer. It is adapted from a computer model which measures economic growth impacts for Ohio municipalities, school districts, and counties. This computer model is described in Economic Growth Impacts: A Technical Description of an Ohio Model for Rural Communities by Morse and Gerard.

While the basic equations used in the computer model and the programmable calculator model are the same, a few differences do exist. The computer model may be used to examine impacts for up to 20 years, but the programmable calculator model described here is limited to 15 years. Also, the computer model provides considerably more detailed results than the programmable calculator model. However, a programmable calculator is more portable, more accessible and generally faster in producing results than a computer.

Users of this model who are unfamiliar with TI-59 calculators should review Appendices A and B before proceeding.

II. Objective of Model

The objective of the model described here is to estimate the economic impact of growth on the budget of the affected city or village and on the incomes of local residents. The types of growth which can be examined include actual or potential new firms and changes in the size of businesses

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already in the community. The effects of incentives, such as the extension of water lines or the granting of a tax abatement, can be included. For more information on the uses of this model, see Economic Growth Impact Model for Rural Ohio (ESO 656) by Morse.

III. Inputs

Listed below is a brief description of each input used for this model with the number of the data register into which each should be placed. For a discussion of the definitions of the 43 input variables used here and prospective sources for the data, see User's Manual for the Ohio Economic Growth Impact Model by Morse, Gerard, and Crawford.

Variable	Data Register	Example
Total new jobs created at new or expanding plant	00	69.
Residential location of worker (percent of total)		
1 - municipal residents	01	0.[illegible]
2 - rest of county residents	02	0.30
3 - in-migrants to the city	03	0.05
4 - in-migrants to the county	04	0.05
5 - commuters from outside county	05	0.20
Average annual wages		
1 - for local employees	06	$11,907.
2 - for in-migrants	07	$13,693.
3 - annual rate of change	08	0.09
New plant's market value		
1 - buildings and other real property	09	$1,251,568.
2 - tangible personal property	10	$5,372,413.
Percentage of workers' incomes spent in town		
1 - by municipal residents	11	0.40
2 - by rest-of-county residents	12	0.30
3 - by commuters	13	0.10
Family size per employee	14	3.5
Income multiplier	15	1.2
Ratio of home values to income	16	2.
City or village property tax rates		
1 - inside millage	17	2.6
2 - outside millage	18	0.
3 - tax reduction factor	19	0.
Variable which equals 1 if the latest appraisal or update of property values took effect this year, or 3 if it was last year, or 2 if it was the year before	20	3.
Expected annual rate of change in property values	21	0.08
Municipal income tax rate	22	0.01
Years of tax abatement granted	23	0.

Variable	Data Register	Example
City of village revenues		
1 - change in state and federal aid	24	$4,704.
2 - miscellaneous revenue per capita	25	$10.39
City or village expenses		
1 - additional annual operational costs for municipal services	26	$10.87
2 - annual payment for capital investments	27	0.
Number of years to be studied (up to 15)	28	15.
Discount rate	29	0.05
Expected average annual rate of inflation	30	0.07
Ratio of value added to sales	31	0.20
Proportion of new or improved homes in town lying outside community reinvestment area (equals 1 if no abatement is given)	32	0.90
Percentage of new income which "leaks" out of local economy		
1 - in the city or village	33	0.30
2 - in the county	34	0.35
Annual rate of depreciation of buildings	35	0.04
Annual probability of plant failure		
1 - in year 1	36	0.014
2 - in year 2	37	0.083
3 - in years 3 through 5	38	0.128
4 - in years 6 through 8	39	0.062
5 - in years 9 and 10	40	0.032
6 - in years 11 through 15	41	0.020
Assessment ratio for property taxes	42	0.41

The data for the 43 input variables should be stored on a magnetic card for use with TI-59 calculators. These cards have a surface similar to magnetic recording tape on one side onto which the calculator may record data or programming. Use of a magnetic card simplifies the process of entering data if changes in the values of input variables are desired.

The data may be stored on a card by entering values from the keyboard into the data registers indicated in Section III and recording the contents of banks 3 and 4. Appendices A and B describe the procedures to be used.

IV. Outputs

If a PC-100 series printer is used with the TI-59 calculator, a printout like that shown in Table 1 will be produced. Each input variable is printed out with the same data register number (00-42) as it has in Section III of this paper. Results are presented with labels and include increased employee income in the city in the first year, annual net gains to the city for years

Table 1

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**********************
   OHIO ECONOMIC
 GROWTH IMPACT MODEL
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INPUT VARIABLES

69.	00
0.4	01
0.3	02
0.05	03
0.05	04
0.2	05
11807.	06
13693.	07
0.09	08
1251568.	09
5372413.	10
0.4	11
0.3	12
0.1	13
3.5	14
1.2	15
2.	16
2.6	17
0.	18
0.	19
3.	20
0.08	21
0.01	22
0.	23
4704.	24
10.39	25
1087.	26
0.	27
15.	28
0.05	29
0.07	30
0.2	31
0.3	32
0.3	33
0.05	34
0.04	35
0.014	36
0.063	37
0.123	38
0.062	39
0.032	40
0.02	41
0.41	42

RESULTS

INCREASED EMPLOYEE INCOME IN THE CITY
184035. YR 1

ANNUAL NET GAINS TO CITY

16811.	YR 1
17686.	YR10
18550.	YR15

PRESENT VALUE OVER

15.	YRS
AT	
5.	%
179733.	MAX
85670.	ADJ

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1, 10, and 15, and the maximum and adjusted present values of net gains. The maximum value is the sumation of each year's net gain after consideration of a time preference for money The adjusted value further considers the impact on net gains of plant failure during the years being studied. More detail on the meaning of results are available in Economic Growth Impacts: A Technical Description of an Ohio Model for Rural Communities by Morse and Gerard.

If no printer is available, the results are available in the following data registers:

Variable	Data Register	Example
Increased employee income in the city, year 1	06	$184,035.
Annual net gains to city		
in year 1	01	$16,811.
in year 10	02	$17,636.
in year 15	03	$18,550.
Present value of net gains		
maximum	04	$179,723.
adjusted	05	$85,670.

V. Procedure

The programming for this model occupies four magnetic cards. The cards are read by the calculator during the processing when needed. The time between card readings varies from a few seconds to over three minutes with total processing time being about 12 minutes.

The following procedure may be used to operate the model:

Step 1 - Turn the calculator off and then on again. This clears all program and data registers.

Step 2 - Insert one side of the magnetic card containing the data into the calculator described in Appendix B. Push the "CLR" key and insert the other side of the data card. The data is now stored in the calculator's memory.

Step 3 - Push the "CLR" key and insert side 1 of the program cards into the calculator. Push the "CLR" key again and insert side 2 of the program cards. The program is now ready to start.

Step 4 - Push the "A" key. The program is now running. Within a few seconds, the input data will be printed. The data should be checked at this point to insure no mistakes have been made. If any mistakes are discovered, make corrections in the data card and return to step 1.

Step 5 - Insert sides 3 through 8 of the program cards into the calculator as the calculator accepts them. Do not force the cards into the calculator. The program determines when each card can be accepted. The time between cards varies from a few seconds to over three minutes.

A few seconds after side 8 runs through the calculator, the results will be printed.

Step 6 - For an additional copy of the results, push the "B" key. This step may be repeated as many times as desired.

Step 7 - To terminate the program, push the "C" key.

If additional runs of the model with one or more changes in the values of inputs are desired, one additional step becomes necessary. After step 2 has been completed, store the new values in the appropriate data registers by using the following key sequence for each change:

n [STO] dr

where n = the new value for the input variable

dr = data register assigned to input variable in Section III

Appendix A

Use of TI-59 Programmable Calculator Data Registers*

Memory Keys - [CMs], [STO], [RCL]

Each time the calculator is turned on, 60 data registers become available. Data registers are special locations in the calculator where numbers which may be needed later can be stored.

Because 60 data registers are available for use, indication of which register is to be used must be specified with that register's two-digit number XX (00-59).

The [CE] and [CLR] keys do not affect what is in the memories. However, pressing [2nd] [CMs] clears all data registers. This places a 0 in all registers

[STO] XX - STORE - This instruction causes the number in the display to be stored into data register XX. The number also stays in the display. Any number previously stored in register XX is erased in the process.

[RCL] XX - RECALL - This instruction puts the number in data register XX in the display. The number also remains in register XX.

Example: Store and recall 5.43

Press	Display	Comments
5.43 [STO] 06	5.43	Store 5.43 in register 6
[CLR]	0	Clear display
[RCL] 08	5.43	Recall contents of register 6

*This discussion was drawn from page II-6 of Personal Programming: A Complete Owner's Manual for TI Programmable 58/59.

Appendix B

Use of TI-59 Programmable Calculator Magnetic Cards*

Any program and any data stored in the calculator may be permanently recorded on magnetic cards furnished with the calculator. The TI-59 is equipped with up to 960 program steps or 100 memory registers. Each time the calculator is turned on the total memory area is partitioned so that there are 480 program steps and 60 memory registers available. For the full range of partitions available, see figure 1.

The total memory area is divided into four banks of equal size. Each magnetic card is designed to record two of these banks, one to a side. For a graphic description of this, see figure 2.

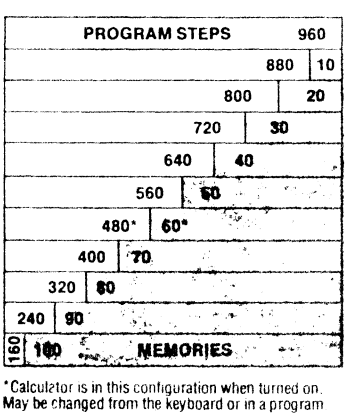

Figure 1

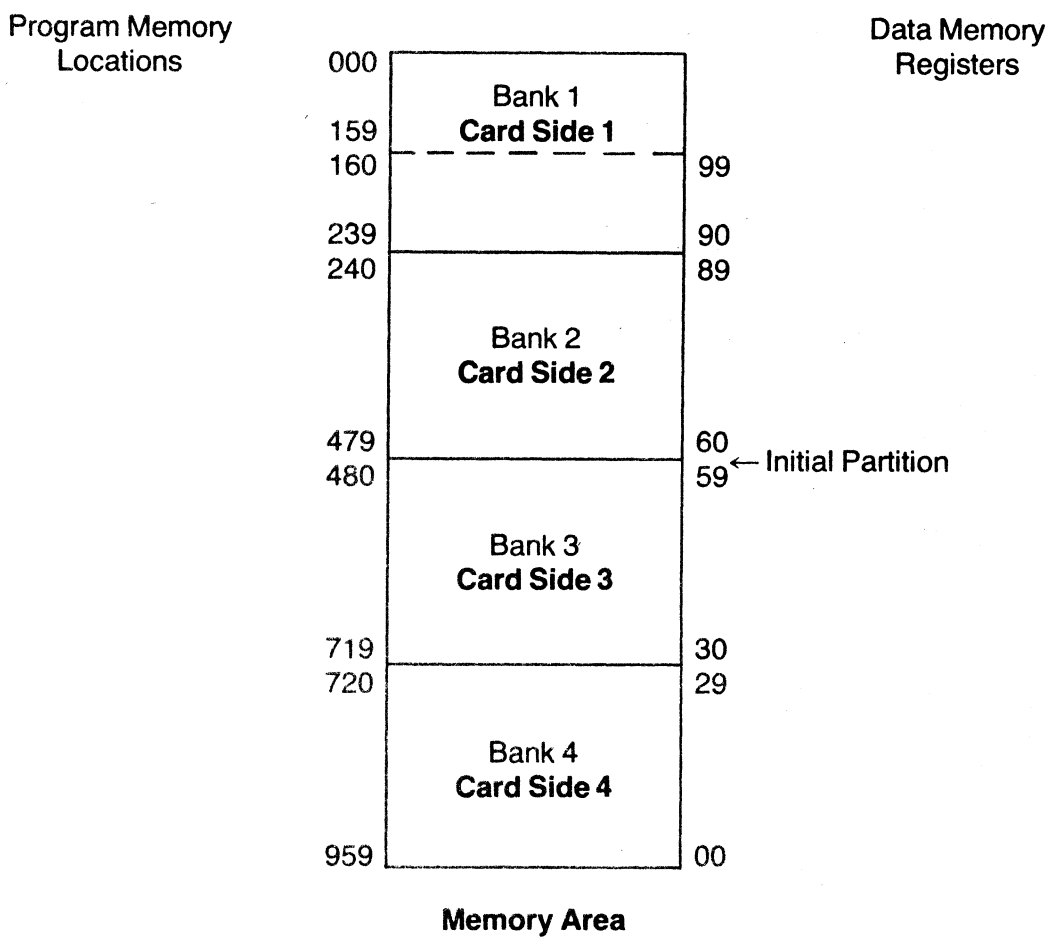

Figure 2

*This discussion was drawn from pages VII-1 through VII-6 of Personal Programming: A Complete Owner's Manual for TI Programmable 58/59.

Recording Cards

Magnetic cards are recorded using the [2nd] [Write] key sequence. To record the contents (data or programming) of bank n (n = 1, 2, 3, or 4) onto card side n, press n [2nd] [Write] and insert the card (printed side up) into the lower slot in the right side of the calculator, as shown in figure 3.

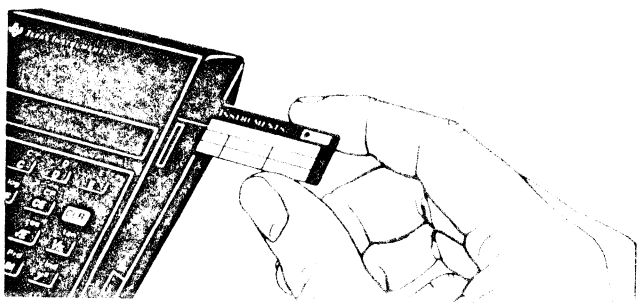

Figure 3

While inserting a magnetic card into the calculator, do not restrict its advance once it is caught by the drive motor. The calculator's display remains blank until recording is completed, at which time the number of the recorded bank is displayed. If the number in the display is flashing, push the [CLR] key and perform the writing procedure again. If the display still flashes, try another magnetic card.

After writing on one edge of a card, the other edge can be written on by turning the card upside down and reinserting it into the same slot on the right side of the calculator. Remember to specify which bank (1, 2, 3, or 4) of the memory is to be written on this side of the card before pressing [2nd] [Write].

When recording data instead of a program, remember that data register 00 is at the end of bank 4 and the data registers number into bank 3.

It's a good idea to label each magnetic card according to the information stored on it using a non-permanent marking pen.

Reading Cards

The calculator's drive motor automatically pulls a magnetic card through the calculator when it is inserted into the card slot if the calculator is not being used for something else at the time. Whether or not the card is read

depends upon what is in the display.

With zero in the display, any bank may be read from a card by simply inserting the card into the slot on the right side of the calculator. If a zero flashes in the display after a magnetic card is entered, the calculator has detected a misread. The [CLR] key should be pushed and the card reinserted.

References

Morse, George W. Economic Growth Impact Model for Rural Ohio. ESO 656, Department of Agricultural Economics and Rural Sociology, the Ohio State University. 1979.

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Texas Instruments Incorporated. Personal Programming: A Complete Owner's Manual for TI Programmable 58/59. 1977.