Title

Financial Viability of Large Land Developments

Author

Dienstfrey, Ted

Publication Date

1966

Return to CPI
(CRC file)

FINANCIAL VIABILITY OF LARGE LAND DEVELOPMENTS

by

Ted Dienstfrey

A Report Sponsored by the Community Development Project
Established by a Ford Foundation Grant

Center for Planning & Development Research:

Institute of Urban & Regional Development
University of California, Berkeley

January 1966

Table of Contents

THE FINANCIAL VIABILITY OF LARGE LAND DEVELOPMENTS

Chapter I: INTRODUCTION

A. Why Be Concerned with Real Estate Profits?

Since the early sixties, private companies have decided, for various reasons, to develop large tracts of land at the fringe of existing urban areas. The Community Development Project, under the direction of Edward Eichler, was established by a Ford Foundation grant to study this activity. This paper, which was originally done for the Community Development Project, is an analysis of one particular aspect of these business ventures: under what financial conditions will these ventures be profitable?

Many individuals, some private consultants and some government officials, believing the development of large tracts of land under single ownership or control to be a "public good," have argued that such developments should be encouraged and subsidized. Such a subsidy is usually thought of as some combination of low interest loans and loan insurance.

The immediate purpose of the redirection of free market forces that would result in either low interest loans to developers or loan insurance to investors is the creation of an attractive investment. Normally in the United States, the proponents of government subsidies of business ventures, any subsidy of any business venture, want to subsidize private investment only to the extent needed to make a risky and hence unattractive investment attractive to the private investor or private developer. Therefore, if responsible public officials want to subsidize large, long-term real estate investment, these officials must understand the profitability of the unsubsidized venture in order to appreciate the magnitude of the subsidy that might or might not be needed.

B. What is Rate of Return?

Often public planners do not understand that a principle and legitimate function of private enterprise is to make a profit. It is even more common for these planners not to know what the term "profit" actually means. In its most simple form, an investor makes a profit if at the end of some time period he has more assets, that is, more money or something that can be turned into money, than he had at the beginning of the time period. Usually it is not too difficult to know if an investment has or has not made a simple profit. But if an investment has made a profit, the investor generally wants to compare this profit with the profit on other ventures. Thus, the normal investor wants to know not only if he has made a profit, but also, first, how much profit he has made and second, what rate of profit, or what is more commonly called "rate of return," he has made. These two questions are not so easily answered.

So far I have talked of evaluating past events, that is, how much profit has been made. Similarly, just as a business firm asks what its profit and rate of return have been, it also asks what they will be in the future. An investor, before entering a venture, will try to compute an expected rate of return assuming certain events. For the most part, this paper will be concerned with evaluating the profit of a set of events that has not yet taken place.

When one is talking about future events, one is evaluating risky situations. After all, until an event has occurred there is no guarantee that it will occur. The more uncertainty of its happening, the higher the risk. One is on very uncertain and therefore very risky ground, for example, when one is predicting single family home sales fifteen years into the future. Normally, a high uncertainty requires that expected profit be high in order to attract an investor. If an investor can make five per cent, for example, by buying risk-free United States Government Bonds, he would, from a purely financial point of view, be silly to invest in a very risky land deal if he only expected to make five per cent. If he expects to make the same rate of profit in both investments, he should take the investment with the lower risk.

It is not immediately apparent why this should be so. A simple example will demonstrate the complexity of the problems. Suppose that every December 31st some mysterious messenger comes into a firm's office and either takes a check for a sum of money or gives a check for some sum of money. This single exchange is what I call the "annual cash movement." The annual cash movement of one hypothetical investment is recorded in Example I. At the end of year 1, the mysterious messenger takes 19.4 million dollars; at the end of year 2, he takes almost .2 million dollars; at the end of year 4, he gives almost 1.0 million dollars, and so forth. At the end of 15 years this agent will have given the firm 23.6 million dollars more than he taken from the firm. The problem of an intelligent investor now is to figure out what is the average annual rate of return he has made on this investment: an investment that takes place over many years.

EXAMPLE I. Annual Net Cash Movements of the Eastvale Development

Year	Cash Movement Negative	Cash Movement Positive	Cumulative Annual Cash Movement
1	19,419,300		-19,419,300
2	192,300		-19,611,500
3	920,200		-20,531,700
4		991,600	-19,540,000
5	14,972,400		-34,512,400
6		5,997,900	-28,514,500
7		7,518,600	-20,995,900
8		7,819,300	-13,176,600
9		7,650,100	- 5,526,500
10	16,232,100		-21,758,500
11		7,500,700	-14,257,900
12		9,444,800	- 4,813,100
13		9,518,900	4,705,700
14		7,453,600	12,159,300
15		11,481,700	23,640,900
TOTAL	51,736,300	75,377,200	

AVERAGE ANNUAL RATE OF RETURN = 6.4%

C. What is This Study About?

This paper reports on my effort to develop a computer model for deriving the rate of return of large land developments. In Chapter Two I shall explain one method of deriving the annual cash movement for large, long-term real estate development. In Chapter Three, I present a method for computing a rate of return from a series of annual cash movements. In Chapter Four, I shall discuss the "leveraging" effect - the possibility of improving a rate of return by borrowing money. And in Chapter Five, I shall discuss the costs of preparing the program.

Throughout the paper, I shall be referring to a computer program that I have written for the University of California, Berkeley, IBM 7094 computer. This program was written primarily to compute the rate of return from variable annual cash movements. The program, by implication, is a model or simulation of what happens in the actual development process.

One of the principle difficulties in the creation of a model lies in deciding on where to draw the line between simplification and over-simplification. For example, in an actual development process, monies can be exchanged on any day of the year. Thus, in actual development, interest is computed to the nearest day. Given this situation, I could have computed a rate of return based on a daily cash movement instead of an annual movement. However, it is the opinion of most real estate model makers to whom I have talked that, since one is dealing primarily with events that have not yet occurred, by attempting to deal with day to day transactions one would not only get bogged down with a great deal of data preparation, but one would also get a spurious accuracy. Throughout the explanation of the model I hope to draw attention to the major simplifications that might cause favorable or unfavorable effects on the rate of return. The hope of the model builder is to make only those simplifications of a process that will have a neutral effect on the problem at hand.

While there are many different types of models, in general they fall into two broad classifications of models: decision making models and decision evaluating models. Certainly the most glamorous family of models is the former. A decision making model, by means of optimizing some set of data inputs, often with weighted statistical probabilities, claims to generate <u>a</u> proper course of action, if not <u>the</u> proper course of action.

Decision evaluating models tend to be less glamorous and less pretentious than the decision making models. This second category of models, and mine is one of them, takes various sets of decisions and, by using a very rigid formulation of reality, evaluates or sums up each data set. The objective of a decision evaluating model is that it will enable one to compare different sets of data inputs.

Decision making models do not evaluate the accuracy of the data inputs. In Chapter Three I shall report on "running" the model with different sale prices of land. It is no secret that normally (let us forget for the time being the vagaries of the federal income tax laws) the higher the sale price of an item, all things being constant, the higher the profit to the seller. But, and this is very important, the model in no way can predict what the sale price actually will be. The model merely evaluates the effect of different sets of sale prices and not the validity of the sale price itself.

Chapter II: ANNUAL NET CASH MOVEMENTS

The aim of this chapter is to explain the way I have conceptualized the annual cash movement of large land developments.[1] First, I discuss why the model does not allow for the retention of income properties. Then I discuss the computation of revenues, that is, the computation of how money is received from the sale of land. And finally I shall discuss the more complicated process of computing costs, that is, the various fixed and variable costs of preparing and selling the land. I shall delay until Chapter IV all mention of loans and loan repayments.

A. Income Properties

The "game" that the model plays is land development. This means that the program can only handle revenue from land sales and cannot handle revenue from income-producing property like apartments, shopping centers and industrial parks. It is true that in the actual development of these large land parcels, the firm normally expects to build and own such income properties. However, since everyday people build, sell and buy apartments, shopping centers, and industrial parks, a firm could enter this area of real estate business without going into the large land development business. It is in order to isolate the profitability of the large land development from the more traditional aspects of real estate investment that the model assumes that a large land developer will sell all developed land. This seemingly forced sale of the model corresponds to the fact that some developers have a separate company handle the rental properties.

---

[1] Through~~out this~~is paper, I shall be referring continually to the Appendix: "A Sample Run of the Financial Viability of the Large Land Development Program." Whenever I refer to a TABLE (all capitals), I shall be referring to some part of that Appendix. Whenever I refer to a Table (not all capitals), I shall be referring to the text itself.

This forced sale should not adversely affect the rate of return. For if the property is a high income property, say a fully-rented, high-rise apartment, this will be reflected in the sale price.

The program does not compute on after-tax profit. This means that the program does not have to deal with three of the most complicated areas in accounting: depreciation;[2] capital gains;[3] and cost depreciation.[4]

---

[2] A brief example might help explain the importance of depreciation allowance. In order to encourage saving and reinvestment, the federal income tax law allows taxpayers to deduct from their gross earnings a sum of money that is equal to some formally derived depreciation of an asset. For example: Assume that a business has a gross taxable income, that is a profit before tax, of $30,000. Normally that business must pay 48% or $14,400 in federal income tax. But further assume that the same firm owns a building or some other property that can be depreciated (among other things one can depreciate are mineral deposits and livestock) that is worth $100,000. The firm, with the agreement of the internal revenue service, interprets the tax law to agree on some expected useful service of the $100,000 property. The assumption is that at some point in the future this property will have to be replaced. The land does not depreciate, but the improvements or buildings do. While there can be a great deal of argument between the firm and the internal revenue bureau on the time period over which the property will depreciate, assume that for this example this particular property will be depreciated in twenty years. This means that for tax purposes of this particular firm this building, from a tax point of view, will be worth nothing in twenty years. Though there are many rates of depreciation, assume that the company accepts a "straight-line" depreciation rate. This means that every year of the depreciation life span of the building, the company can deduct one twentieth of the value of the building from its taxable income. Thus, the net taxable income of this hypothetical firm is now $30,000 (gross taxable income) minus $5,000 (depreciation) or $25,000. The income tax the company now pays is 48% of $25,000 (net taxable income) or only $12,000. By using the "tax shelter" of the depreciation fund the company pays $2,400 less in taxes

[3] The capital gains problem revolves around the issue of who is and who is not a "dealer". A dealer, that is, a company or individual who makes his living by buying and selling land (or some other capital asset), must pay an income tax of 48% of profits. A non-dealer, who incidentally sells a capital asset for profit, pays an income tax of only 25% of profit. The developer, by owning and operating the income property for a few years before selling it, hopes to be classified, in respect to these income properties, a non-dealer. If the developer is so classified, his income tax on these properties is approximately half of what he would otherwise pay

[4] For income tax purposes, the profit on the sale of a particular piece of land in a large development will depend in part on the allocation of cost of major capital improvements. For example, suppose a developer builds a road at a cost of 1/4 of a million dollars to service 90 acres of single

The importance of these three areas is that they "shelter" profits, that they reduce the amount of profit one must pay in income tax. This means that if, and this is a big if, a company makes a large before-tax profit through land development, the company looks for a means to "shelter" this profit from income tax. If, on the other hand, a company makes a small before-tax profit, or even loses money on a land development, there is little need for the company to worry about sophisticated means to "shelter" non-existent profits. One must evaluate the need of a tax shelter only after one knows what there is to shelter, only after one knows what to expect in the way of before-tax profits. Thus, it would be extravagant and unnecessary to build a four-car garage before one knew if one were getting more than a single Volkswagen.

4(Cont.)
family land and 10 acres of commercial land. The developer and the internal revenue service must agree on a scheme that allocates the cost of this road to each acre of land sold. The developer, aware of the expected cash movement of the project, may want to consider allocation schemes as different as the following three schemes: 1. allocate 1/100 of the cost of the road to each acre of land serviced by it; 2. allocate the cost proportionate to the sale price of each acre; 3. if the land is to be sold over several years, allocate a higher cost to the land sold first. The developer's objective is both to delay the payment of income taxes and, if he expects some profits to be taxed at a capital gains rate, to allocate as small an allocation as possible to the capital gains part of the project.

For a more expanded discussion of the importance of income tax on the profits of large land developments, see Eichler, Edward P., The Community Builders, Chapter II, "Taxation" (unpublished m.s.)

B. Revenue

Revenue in this model comes from selling land. In the proto-typical example that appears in the Appendix, there are 14,035 units of land to dispose of. Originally I conceived of a unit as an acre, but there is no conceptual harm done if one wants to think of these units as lots, dwelling units, square feet, or some other measure.

In order to compute the revenue from the sale of these units, one must "know": 1. How many units will be sold each year; 2. The sale price of each unit; and 3. The terms of the sale. As has been mentioned in the Introduction, one cannot know with certainty or any known degree of uncertainty the answers to any of these questions. One must make assumptions, evaluate the likelihood of these assumptions, compute the effects of these assumptions, and then gamble that the assumptions approximate what will actually happen.

When it comes to assuming sale of land, one can assume that different uses to which the land will be put will affect both the rate and the price that the land will sell for. The model will accept up to eight different types of land uses. In the example in the Appendix, the 14,035 units have been classified into six types of land uses: single family, apartments, commercial, industrial, public lands, and contributed.

TABLE 1 shows the set of sales volume rate assumptions that were used in this demonstration run of the program. This TABLE reports sales rates for each year up to year 10, and then groups sales rates into five year periods for a maximum of 30 years of project life. Since the demonstration project is terminated in 15 years, years 16 to 30 have a zero sales rate. It was found that aggregating the data resulted in a higher than actual rate of return. For various internal computation work, input data on sales volume is actually entered annually for each year of the project life. Nevertheless, TABLE 1 prints this sales data for the last 20 years of the project in five year groups partially because that was the way it was originally programmed, partially because printing the data in disaggregate annual form would require two more pages, and partially to remind the user of the difficulty of predicting sales rates.

TABLE 3 shows the per unit sales price for each land type per time period. In the present example, each unit of single family land in year one would, if sold, sell for $5,000. In the five year period of years 11 through 15, each unit of single family land sold sells for $10,000.

The horizontal line in TABLE 3 called "TOTAL VALUE" is the value of all sales for the respective period. In years 1, 2, and 3, either no land is developed and sold, or, in the case of "CONTRIBUTED" land, it is developed but has no sales value. Thus, there are no sales revenues in years 1, 2, and 3. In year 4, according to TABLE 1, 300 units of single family land and 350 units of public lands are sold. Returning to TABLE 3, since each unit of single family land in year 4 sells for $5,000 and each unit of public land sells for $3,000, the total sales value for year 4 is 300 times $5,000 plus 350 times $3,000, or $255,000. The total sales for each year is computed in a similar manner.

The horizontal column of TABLE 3 called "TOTAL" shows the absolute amount of income received from the sale of each land use at the end of the project. In this particular example, single family land sales bring into the project 38.2 million dollars. This figure could have been changed either by changing the amount of single family land sold, or by changing the value for which it was sold, or by changing the timing (land sold later sells for a higher price) of the land sales. TABLE 3 computes the total revenue for the project. In this example the total revenue is a little more than 101 million dollars.

The total revenue by year is entered into TABLE 6 "CASH MOVEMENTS WITH NO LOANS," on line one which is called "TOTAL SALES." Line one of TABLE 6 therefore reports the sales rates and volumes of the land. Line two of TABLE 6 called "CASH PROCEEDS" reports the terms of the land sales. At present, the program has a single method of handling the terms of sales. It is assumed that for all sales, except those in the last year of the project, the terms of sale will be 50% down and 50% to be paid in the following year. In the last year of sales the model assumes that cash proceeds are equal to the total sales. While in actual development there will be many separate terms of sale, consultants have privately agreed that this half-down-half-in-a-year terms of sale that has been incorporated into the program is a reasonable approximation of an actual sales situation.

C. Cost

A principal objective a developer has is to handle the cost of a large land development in such a manner that the actual payment of a cost is delayed as long as possible. In Chapter III, it will be demonstrated that it is inherent in the computation of a rate of return that the greater the delay in paying a bill, the less the bill actually becomes. At this time, the discussion will be limited to explaining an accounting system that gives the developer enough flexibility to evaluate alternative development schemes. In this model of development there are five principal types of costs: real estate taxes, costs of sales, special costs, project costs, and unit costs of development. Each cost will be discussed separately.

Real Estate Tax

While there is no doubt that developers will have to pay real estate taxes of the undeveloped or unsold land, there is a question as to what these taxes will actually be and how they will be computed. An indication of how far apart the developer's view can be from the assessor's is suggested by fact that the Orange County Assessor has started legal proceedings that could culminate in the Irving Ranch paying nine million dollars more per year in real estate taxes than it is currently paying.

Real estate taxes are based on some percentage of value of the property in question. Assessors have a great deal of practice and competence in assessing farm land on the one hand, and single purpose urban parcels such as homes and stores on the other. These assessments will have some relationship to the price the land would receive if it were sold. It is the existence of a "market" for this land that enables the assessor to justify his assessment.

Large land developments are much harder to assess. What, after all, is the value of land that may be or is planned to be a lot for a single family home 10 or more years from now? Since there are very few sales of large land parcels, there is at present no known market for such land.

The method of computing real estate taxes in this program can be considered one way of estimating the actual assessment process. In the Appendix, below TABLE 2, one sees the statement "REAL ESTATE TAX IS 1.0% OF THE VALUE OF THE UNSOLD LAND." As this statement suggests, there are two variables in computing the tax: the value of the unsold land itself, and the tax percentage of the land. It was the judgment of various individuals familiar with the business that a tax of 1.0% of value used in the example was "reasonable." There was not such unanimity of opinion on how to compute the actual value of the unsold land.[5]

The model assumes that for the first two years of the project life, the land is worth some amount that approximates or is actually equal to the cost of the land. This value, which is an independently entered variable, is recorded in TABLE 2 in the row called TOTAL VALUE for years one and two. Once the development process has begun (that is, once plans have been made, zoning agreements reached, advertising started, financing arranged) the land, if there is a market for it, should have increased in value. The problem is how to compute the rate of increase.

The model assumes that the principal variable in the rate of increase of value of unsold land is the rate of sale of single family land. In TABLE 2, a value for each unit of unsold land by land type is entered for year three. This is called the initial value and represents the above mentioned servicing of the land. The program then computes from TABLE 1 the rate at which single family land is sold (assuming that the first land type designated is always single family land). This rate of sale of single family land appears just above TABLE 2. In the example, since at the end of year four 6% of the single family land is sold and since, as stated in TABLE 2, the value of each unsold unit will increase 2% for every 1% of single family land sold, the value of all land types at the end of year four will be 12% higher than the initial value entered.

---

[5] An earlier version of this model assumed a constant increase in the value of the unsold land regardless of the rate of development. Upon reflection, this was considered to be quite unreasonable.

The horizontal line "TOTAL VALUE" in TABLE 2 shows the value of undeveloped land at the end of each time period. For the grouped time periods, the value shown is that tax paid in the last year of the group. The taxes paid for the first four years of the group as well as the taxes for the other years all appear in line seven of TABLE 6.

Cost of Sales

Cost of sales varies directly with the total sales. At the bottom of TABLE 3 there is a line which says "EACH YEAR A COST OF SALES EQUAL TO 1.0% OF THE TOTAL SALES IS ADDED TO COST." This item is assumed to cover closing costs though it may also include salesmen's commissions and some advertising. As it is currently programmed, the cost of sales varies directly with the rate of sales as shown in TABLE 1 and the price of sales as shown in TABLE 3. In actual development for large sales, this item may be less than linear. So far no one has suggested a more accurate description of the variable.

Project Cost

TABLE 5 shows the major costs of the project by time period. These costs are such things as the cost of the land, utilities, site preparation, and so forth. The fact that costs are grouped into five year periods for the last 20 years of the model will give a slight boost to the computed rate of return. For these grouped years the program assumes that one-fifth of the grouped cost was spent each year. The program will accept up to nine different types of costs. It requires very minor re-programming to change the names of these costs.

One purpose of TABLE 5 is to experiment with different development plans. Assume that a project could be developed either with one large water pumping station or with two small stations. In order to compare these two development schemes one would run the program twice, holding everything constant but the cost of these stations and see which scheme produced a higher rate of return.

In the example run in the Appendix, there are only three types of project costs: land costs, discretionary costs, and other costs. Discretionary costs in this project are defined as the amenity items (a lake, a golf course, parks) that the developer builds, not in order to develop the land itself, but in order to improve the attractiveness of the product to the consumer or final home buyer. The developer, from a financial point of view, should include only those discretionary items that he believes are necessary to maintain either his sales rate or his sales price.

Until now, most plans for large developments have not explicitly stated the relationship between discretionary costs and sales. If a planner were to recognize the implications of this relationship, he might try to estimate changes in sales price or sales rate due to changes in discretionary spending and make the separate runs of the program in order to evaluate his different alternative development plans. Thus, if a planner or a developer thought that a sales rate might be down 10% if he eliminated all discretionary spending he could, with a simple change of inputs, see if he might not be better off with no discretionary spending and the 10% lower sales rate. This type of analytical use of the model tries to clarify the areas in which decisions by the developer must be made.

In the example in the Appendix, all necessary development costs have been lumped together under the generalized name "OTHER." This was done because useful disaggregated costs were not available.

The negative figures in the "discretionary" line of TABLE 5 indicate that facilities that the developer paid for earlier have been sold.

Special Costs

TABLE 4 shows those costs that the developer believes will be "triggered" by some percentage of single family land development. In the example, only one special cost has been entered (the program will accept an unlimited number) in order to demonstrate the concept of triggered cost. The special cost in the example is for an expenditure of $250,000 to build a major road after 25% of the single family land has been sold. The program computes from the sales rates in TABLE 1 that the expenditure will occur in the 7th year. Single family land is used as the trigger for the expenditure for the same reason that it has been used as the independent variable in the computation of real estate taxes; that is, because it has been assumed that the rate of sale of single family land is the best indication of the progress of the total project.

Unit Cost

If data were available, the program would multiply the number of units of a particular land type that is to be developed as indicated in TABLE 1 by the respective unit cost of development as indicated in TABLE 1A. The unit cost would have a lead time of one year. If, for example, it cost an average of $200 to prepare a unit of single family land for sale, the program would multiply the sales rate in year three, which is 300 single family units, by this $200 cost and enter the product of $60,000 in column 2, row 4 of TABLE 6. Notice that the sale took place in year three, but the development cost is assumed to have occurred in year two. In the demonstration run of the program in the Appendix, the unit costs have all been zeroed out.

D. Investments and Return

The program at this point computes the annual total development cost for line 8 of TABLE 6 by summing special costs, project costs, unit costs, costs of sales, and real estate taxes which are lines 4, 5, 6, and 7 of TABLE 6. The annual net cash movement which is line 9 of TABLE 6 is computed by subtracting the total annual development cost, line 8, from the annual cash proceeds, line 2.

When costs exceed cash proceeds, the annual cash movement is negative. A negative cash movement is the model's way of showing how much new money the developer must invest in the project. And conversely, a positive net cash movement is the model's way of showing net returns on this investment.

For ease of data preparation as well as ease of computation, all cash movements in the program are computed on the last day of the year. Variations within the year that would occur in real developments are disregarded. Thus, a new investment occurs only if the development uses the developer's money for at least one year. A development program for a large land venture that would show a positive cash movement for every year of the development would, according to this model, have no meaningful rate of return because such a project would be showing return on no investment. While this simplification means that the model cannot be used as a universal investment model, it does not prevent the analyses of investments that do indeed occur over many years.

In most cases a firm will want to know not only a rate of return on invested money, but also its "exposure;" that is, how much money must be invested at any one time. The program shows the total exposure at the end of each year in line 10 of TABLE 6, which is called "CUMULATIVE NET CASH MOVEMENT." The maximum exposure in the present example is 34.5 million dollars at the end of year five. The "break even" point in the example is year 13, which is the first year that the development has received more total returns than total investment to date.

In computing the rate of return, a value must be attached to any unsold land. The program checks to see if there is any unsold land. If there is, the program first computes a gross value of this land by multiplying the last sales price of the land by land type as recorded in TABLE 3 by the amount of land left in that land classification type; second, computes the number of years it would take to sell this land by assuming that the land can be sold at the same rate of sales as the average rate of total sales in the last five years; and third, uses the following equation to compute the net worth of the remaining land:

$$NW = \sum_{j = 1,NY} \left(\frac{(GW/NY)}{(1+DF)J}\right)$$

NW - net worth of remaining land

GW - gross worth of remaining land

NY - number of years it will take to sell remaining land

DF - discount factor, percentage of gross worth it takes to prepare and sell land

If a project calls for the sale of all of the land, there is no need to worry over whether or not this equation represents a fair appraisal of the remaining land. The equation shows that the net worth of the unsold land varies with the amount of land unsold and indirectly with the discount factor of selling the land. By raising the discount factor, one lowers the estimate of the net worth of the undeveloped land.

The program computes a net worth of the unsold or residual land at the end of year 10 and at the end of the project life, which in the example is year 15. Using the annual net cash movement and the net worth of the remaining land, the program computes a rate of return at the end of these two time periods. The actual computation process of these figures will be explained in the next chapter.

It was decided to compute two rates of return because of the belief that many businessmen, before investing in a project so full of uncertainty, would want to expect at least a "reasonable" rate of return at the end of 10 years before gambling on a "phenomenal" expected rate of return some 15, 20, or 30 years from now. The assumption is that given an expected low or negative rate of return at the end of year 10, most businessmen would not rush into the large land development business. The future course of large land developments may be such as to disprove this assumption.

Chapter III: RATES OF RETURN

In this chapter I shall explain the rate of return equation which is programmmed into the model. By means of a series of examples of increasing complexity, I hope to justify the validity of the final equation. It should become apparent from the examples that the major difficulty in computing a rate of return is knowing how to treat the timing of cash movements.

The first section of the chapter merely points out the time and interest question. I then discuss the simple interest equation and show how this equation is not adequate to help one analyze large land developments. Following the simple interest discussion, I demonstrate the inadequacy of the normal compound interest formula and then introduce the formula which is adequate to handle investments as complex as large land development ventures. And finally, I explain briefly the actual method of computation used in my computer program.

A. Time and Interest

All of us intuitively know the importance of time and interest. This, of course, does not mean that we are always aware of using these concepts. The following example tries to show how many problems of choice are in fact interest problems.

Assume that one has four available uncles, each of whom offers as a birthday present one of the following choices: Uncle A offers a dollar on the day of the birthday or two dollars the day after the birthday. Uncle B offers a dollar on the birthday or two dollars six months after the day of the birthday. Uncle C offers a dollar on the birthday or a dollar and one cent the following day. And Uncle D offers a dollar on the birthday or a dollar and one cent in six months.

Most of us would have no difficulty in telling these uncles which of these choices we would accept.

A person who completely disregarded interest and time would accept the choice of more cash, that is, in each case the second choice of each uncle. The compulsively rational individual would compute the rate at which the first offer would have to be invested in order to equal the second offer. But most of us would choose between the offers with only a more general weighing of the present offer against the future offer. Table III-1 summarizes the offers and shows the simple annual interest rate at which the first offer would have to be invested in order to equal the second offer.

Table III-1 - Birthday Choices Presented by Four Uncles

Uncle	Present Offer	Future Offer	Simple Annual Rate That Makes Present Offer Equal to Future Offer
A	$1.00	$2.00 next day	36,500%
B	1.00	2.00 six months	200
C	1.00	1.01 next day	365
D	1.00	1.01 six months	2

B. Simple Interest and Rates of Return

Interest rates and rates of return are two aspects of the cost of money. An interest rate is what one person, if he is a borrower, pays to, and, if he is a lender, receives from another person. An interest rate is often viewed as the cost of money between two people or an external cost of money. A rate of return is the amount of money one pays to oneself for the use of one's own money. Sometimes a rate of return is called an internal interest rate or the internal cost of money.

It is no exaggeration to say that most of modern business revolves around the relative cost of money between various business ventures. An individual in a pre-industrial barter economy can afford the luxury of looking down one's nose at the problems of interest, and indeed dismiss them by muttering some pronouncement about usury. However, if someone is concerned with the workings of our current economy he must take the time to familiarize himself with the mathematics of interest.

If one borrows money from a bank, one expects to pay an interest rate to the bank for the use of the money. From the bank's point of view, it expects to make a rate of return on the money it has invested in you. Equation 1 shows the relationship between the amount borrowed, the interest rate, and the amount paid back when one does not consider time. Equation 1 is the equation for computation of simple interest.

Equation 1: $$R = A + A(I)$$

From the borrower's point of view:

A = amount borrowed
R = amount that must be repaid
I = interest rate

From the lender's point of view:

A = amount invested
R = amount of return
I = rate of return

Equation 1A below is the same as Equation 1 except that the algebraic process of "factoring" the "A's" has been performed.

Equation 1A: $$R = A(1+I)$$

Equation 1B is the same as Equation 1A except that both sides of the equation have been divided by "(1+I)".

Equation 1B: $$A = \frac{R}{1+I}$$

In all three of the above equations, one can subtract the investment from the return and find the amount of money earned.

$$E = R - A$$

E = amount of money earned

Since there are three variables in Equation 1 (A, R, and I), if one knows two variables he can find the third. For example, if one were to make an investment with a total cost of $500, in order to receive a total return of $525 one could find the rate of return for this investment.

$$A = \frac{R}{1+I}$$

$$500 = \frac{525}{1+I}$$

$$I = .05 \text{ or } 5\%$$

In the proto-typical land venture in the Appendix, TABLE 6 shows that the venture has a total investment of 77 million dollars and a total return of 101 million dollars. Using Equation 1, one could compute a simple, and indeed simple-minded rate of return.

$$A = \frac{R}{1+I}$$

$$77 = \frac{101}{1+I}$$

$$I = .31 \text{ or } 31\%$$

The reason this figure of 31% is totally unacceptable is that it does not consider the timing of the investments and returns of the venture, that is to say, it does not consider the effects of compounding interest.

C. Compound Interest

Consider the following two alternative ventures and decide which is the better venture. Venture A calls for an investment of $300 for one year at which time the investment will pay back $365. Venture B also calls for an investment of $300 and a payback of $365, but the investment period is two years. The problem, of course, is to compute the rate of return of each investment. Intuitively, Venture A seems to be the better investment. However, if the rate of return for these two ventures is computed by use of the simple interest formula, one will find out that the investments have the same rate of return.

Venture A: $A = \frac{R}{1+I}$

$$300 = \frac{365}{1+I}$$

$$I = .21$$

Venture B: $A = \frac{R}{1+I}$

$$300 = \frac{365}{1+I}$$

$$I = .21$$

The major investment difference between Venture A and Venture B is that the payback period is twice as long in Venture B as in Venture A. One therefore needs an equation that takes into account the time factor. The equation that suffices is the normal compound interest equation of:

Equation 2: $A = \frac{R}{(1+I)^y}$ Equation 2A: $A(1+I)^y = R$

A = investment
R = return
I = rate of return
y = number of periods (generally years) that the rate is compounded

The relationship between the simple interest formula and the compound interest formula is suggested in an appendix to this chapter.

Using Equation 2A, one can easily compute the true rates of return for Venture A and Venture B.

Venture A: $A(1+I)^y = R$

$300(1+I)^1 = 365$

$I = .21$ or 21%

Venture B: $A(1+I)^y = R$

$300(1+I)^2 = 365$

$I^2+2I-.21 = 0$

$I = .10^*$ or 10

*Since we are looking for a positive term, the negative root in the quadratic equation has been ignored.

Thus, Venture A turns out to have a rate of return of more than twice that of Venture B. In this example, intuition and formal analyses concur. As problems become more complex, intuition is not always as accurate an indication as analyses.

By use of the standard quadratic equation, it is fairly simple to solve the compound interest equation when y is equal to 2, 1, or 0. It becomes more difficult for higher powers of y. Consider the following two ventures: Venture C calls for an investment of $1,000 and an expected return in four years of $1,464. Venture D calls for an investment of $1,000 in the hopes of generating an expected return of $1,678 in six years. In order to discover which venture has a better expected rate of return, one must resort to the use of logarithms.

Venture C: $A(1+I)^y = R$

$1,000(1+I)^4 = 1,464$

$4 \log (1+I) = \log 1.464$

computation omitted

$I = .10$ or 10%

Venture D: $A(1+I)^y = R$

$1,000(1+I)^6 = 1,678$

$6 \log (1+I) = \log 1.678$

computation omitted

$I = .09$ or 9%

Thus, Venture C, which intuitively might not have looked as good as Venture D, is actually the better investment.

D. Discounting and Rates of Return

In Ventures A to D, a time factor has been associated only with the future return. One must now consider what this time factor does to the return and what must be done if a time factor for the investment as well as the return is introduced. First, let us look at Equation 2 again:

$$A = \frac{R}{(1+I)^y}$$

If one is solving for a rate of return, that is, one knows A, R, and y, and is solving for I, then:

A = investment
R = return
I = rate of return
y = number of time periods that separate R from the present

If one is solving for an investment, that is, one knows R, I, and y, and is solving for A, then:

A = present worth of some sum
R = undiscounted future worth of some sum
I = discount rate
y = number of time periods that separate R from the present

The mathematical effect of the term $(1+I)^y$ is to make the R term smaller. The larger the I or the larger the y, the smaller the R. One way of interpreting the effect of the $(1+I)^y$ term is represented by the concept of "discounting." In discounting, by assuming some I (a discount factor), one finds "the present worth" of some future sum. The further into the future or the higher the discount factor, the smaller the present worth of the future sum.

The mathematical difference between finding a rate of return and discounting is that in finding a rate of return one assumes A, R, and y, and solves for I; while in discounting one assumes R, y, and I, and solves for A. It is much easier to discount or solve for A than to solve for I. If this is not clear, one should try to solve the following two examples: Given A=1000, R=5000, and y = 5, find I; given R=6000, y=4, I=.07, find A.

Equation 2, by implication, does consider a time factor for the investment. Since, up to now, it has been assumed that A is some investment that takes place at the present time, the time factor for A has been 0. Equation 3 is the same as Equation 2 except that it shows the implied time factor for A.

$$\text{Equation 3:} \quad \frac{A}{(1+I)^{ya}} = \frac{R}{(1+I)^{yr}}$$

ya = time factor of investment
yr = time factor of receipt

If ya = 0, the term $(1+I)^{ya}$ will equal 1, and Equation 3 will look exactly like Equation 2.

One must have the ability to associate a time factor with an investment in order to solve the following type of problem: What is the rate of return for an investment of $220 made one year from now which will generate an expected return of $242 two years from now?

$$\frac{A}{(1+I)^{ya}} = \frac{R}{(1+I)^{yr}}$$

$$\frac{200}{(1+I)^{1}} = \frac{242}{(1+I)^{2}}$$

computation omitted

$$I = .10 \text{ or } 10\%$$

With the same example in mind, consider the effect of discounting both the investment (or expenditure) and the return at 10%. In other words, at a discount factor of 10%, what is the present worth of expenditures and the present worth of receipts in this example?

Discounting the expenditure at 10% to find the present worth of expenditures:

$$\frac{A}{(1+I)^{ya}} = X$$

$$\frac{200}{(1+.10)^{1}} = X$$

$$200 = X$$

Discounting the receipts at 10% to find the present worth of receipts:

$$Z = \frac{R}{(1+I)^{yr}}$$

$$Z = \frac{242}{(1+.10)^{2}}$$

$$Z = 200$$

It is important to realize that when the discount factor is the same as the rate of return, the present worth of receipts is equal to the present worth of expenditures. This mathematical relationship is, in fact, one way of defining a rate of return. Thus, a rate of return is that discount rate that sets the present worth of expenditures equal to the present worth of receipts.

E. Complex Investments

In normal business accounting, one computes a rate of return at the end of each year of operations. Usually, one simplifies the computation by deriving a figure for the worth of the investment at the start of the year and then computes the worth of the investment minus the year's cost at the end of the year. The assumption is that each business year is a new accounting period. This assumption is justified because one expects to make a positive rate of return, that is, to make money every year.

The practical difficulty one would encounter in computing an annual rate of return for large land investment would be the assignment of some value to the unsold land at the beginning and end of each year. In the discussion of real estate taxes in Chapter II, it was pointed out that the absence of an active market in large land sales made it very hard, if not impossible, to assign a "true" value for this unsold land.

If one uses the entire life span of the project instead of individual years to compute an average annual rate of return, one completely circumvents the problem of the assignment of value to the unsold land.

Closely related to the concept of a venture whose rate of return must be computed over many years is the concept of a venture which has multiple investments and multiple returns. The following example, Venture XAC, with its multiple returns and multiple expenditures that take place over more than one year, is an example of what is called here "complex investments." In Venture XAC, a firm: buys a piece of land for $12,000 at the beginning of year 1; sells half of the land at the end of year 1 for $7,200; grades the remaining land at the end of year 1 for a cost of $2,400; and sells the remaining land at the end of year 2 for $11,200. The problem is to find the average annual rate of return of this venture. The cash movements of this venture are summarized in Table III-2.

Table III-2 - Venture XAC Cash Movements with No Loans

Year	0	1	2	Total
land	12,000	-	-	12,000
grading	-	2,400	-	2,400
Total Cash Out	12,000	2,400	-	14,400
Total Cash In (Sales)	-	7,200	11,200	18,400
Net Cash Movement	-12,000	4,800	11,200	4,000
Cumulative Cash Movement	-12,000	-7,200	4,000	

Using the definition that the rate of return is that discount rate that sets the present worth of receipts equal to the present worth of expenditures, one has the following equation to solve:

Equation 4: $$\sum_{j=1,N}\left(\frac{A_j}{(1+I)^j}\right) = \sum_{j=1,N}\left(\frac{R_j}{(1+I)^j}\right)$$

line 1 $$\frac{A_0}{(1+I)^0} + \frac{A_1}{(1+I)^1} + \frac{A_2}{(1+I)^2} = \frac{R_0}{(1+I)^0} + \frac{R_1}{(1+I)^1} + \frac{R_2}{(1+I)^2}$$

line 2 $$\frac{12,000}{(1+I)^0} + \frac{2,400}{(1+I)^1} + \frac{0}{(1+I)^2} = \frac{0}{(1+I)^0} + \frac{7,200}{(1+I)^1} + \frac{11,200}{(1+I)^2}$$

line 3 $$0 = -12,000 + \frac{4,800}{(1+I)} + \frac{11,200}{(1+I)^2}$$

line 4 computation omitted

line 5 $$I = .20 \text{ or } 20\%$$

Notice that in line 3 of the above example the term $\frac{2,400}{(1+I)^1}$ has been algebraically added to the term $\frac{7,200}{(1+I)^1}$ to equal the new term $\frac{4,800}{(1+I)^1}$. Thus, line 3 is no longer the disaggregate expenditures and returns, but is the annual net cash movement of the venture. What has happened can be expressed mathematically by the following:

$$\Sigma\left(\frac{A_j}{(1+I)^j}\right) = \Sigma\left(\frac{R_j}{(1+I)^j}\right)$$

$$0 = \Sigma\left(\frac{R}{(1+I)^j}\right) - \Sigma\left(\frac{A_j}{(1+I)^j}\right)$$

$$0 = \Sigma\left(\frac{R_j - A_j}{(1+I)^j}\right)$$

since $(R_j - A_j)$ = net cash movement which is designated "NCM"

Equation 5: $$0 = \Sigma\left(\frac{NCM_j}{(1+I)^J}\right)$$

It is this final equation which is solved by the computer program. It is the principal contention of this paper that this equation, Equation 5, is the logically and mathematically sound way to find a rate of return for a large land development.

F. Computing the Rate of Return

The computer program solves for "I" in Equation 5 by an iteration process. It first sets "I" equal to zero and computes the summation. If the summation is greater than zero, it increments "I" by .01 and recomputes the summation and checks to see if the summation is greater than zero. The program repeats the process of incrementing "I", computing the summation, and checking the total to see if it is greater than zero until the total becomes less than zero. Once the total becomes less than zero, the program subtracts .01 from "I" and re-enters the iteration cycle with increments of .001. While it is possible to find "I" to any number of decimal places, the program computes "I" accurately only to the nearest whole percentage point.

Once the program has been loaded into the computer (a process which takes about 35 seconds of computer time), it takes less than four seconds to manipulate the data, prepare the printout sheets, and compute the rate of return for the data. The program is written so that it can handle in increments of four to six seconds any number of different development plans of the same project and any number of totally different projects with one pass of the program through the computer.

Chapter III Appendix: SIMPLE AND COMPOUND INTEREST

The simple interest equation states that the return is equal to the original amount (investment) plus some percentage of the original amount. The following series of equations starts with the simple interest equation and ends with the compound interest equation.

At the end of year 1:

$$R_1 = A + A(I)$$
$$R_1 = A(1 + I)$$

At the end of year 2:

$$R_2 = R_1 + R_1(I)$$
$$R_2 = A + AI + (A + AI)I$$
$$R_2 = A + AI + AI + AI^2$$
$$R_2 = A + 2AI + AI^2$$
$$R_2 = A(1 + 2I + I^2)$$
$$R_2 = A(1 + I)^2$$

At the end of year 3:

$$R_3 = R_2 + R_2(I)$$
$$R_3 = A + 2AI + AI^2 + (A + 2AI + AI^2)I$$
$$R_3 = A + 2AI + AI^2 + AI + 2AI^2 + AI^3$$
$$R_3 = A + 3AI + 3AI^2 + AI^3$$
$$R_3 = A(1 + 3I + 3I^2 + I^3)$$
$$R_3 = A(1 + I)^3$$

At the end of year N:

$$R_N = R_{N-1} + R_{N-1}(I)$$
$$R_N = A + \alpha AI + \beta AI^2 \;.......\; \gamma AI^{N-1} + AI^N$$
$$R_N = A(1 + \alpha I + \beta I^2 \;.....\; \gamma I^{N-1} + I^N)$$
$$R_N = A(1 + I)^N$$

Since I have not proven that the terms α, β, and γ are in fact equal to the terms in the binomial expansion, this can not be considered as a formal proof.

Chapter IV: FINANCING

One of the principle attractions of a real estate development is that one can often do business with a very small amount of capital. The reason for the low amount of capital in real estate is that banks and other financial institutions are willing to loan money against some percentage of the worth of land and improvements. In this chapter I shall first, by means of an example, show how the cash movements associated with financing are treated in the computation of a rate of return. I shall then briefly explain the financing variable which the program can handle. And, finally, I shall make a few comments on computed rates of return.

A. Leveraging

Financing an investment in order to raise the expected rate of return is called "leveraging". An investment can be leveraged if the interest rate of the loan is lower than the rate of return on the unfinanced project. The amount of leveraging varies first, with the difference between the interest rate of the loan and the rate of return on the unfinanced project, second with the length of the loan, and third with the size of the loan.

Consider the following project. An investment of $10,000 will return $11,000 at the end of one year. The rate of return of this unfinanced project is 10%.

Table IV-1 - Cash Movement with No Loans

Year	0	1	Total
Cash Out	10,000	-	10,000
Cash In	-	11,000	11,000
Net Cash Movement	-10,000	11,000	1,000
Cumulative Cash Movement	-10,000	1,000	

$$0 = \Sigma \left(\frac{NCM_j}{(1+I)^j}\right)$$

$$0 = \frac{-10,000}{(1+I)^0} + \frac{11,000}{(1+I)^1}$$

Rate of return on unfinanced project equals 10%.

Now consider the same project if one can borrow half of the investment for one year at a 4% interest rate.

Table IV-2 - Cash Movement with Loans

Year	0	1	Total
Project Cost	10,000	-	10,000
Debt Service[1]	-	5,200	5,200
Total Cash Out	10,000	5,200	15,200
New Loans	5,000	-	5,000
Sales	-	11,000	11,000
Total Cash In	5,000	11,000	16,000
Net Cash Movement	-5,000	5,800	800
Cumulative Cash Movement	-5,000	800	

([1]Includes principal and interest payments)

Since before financing one makes a return of one thousand dollars and after financing one makes a return of only eight hundred dollars, one might assume that one is worse off after financing. But before deciding, one should compute the rate of return for the financed project.

$$0 = \Sigma \left(\frac{NCMj}{(1+I)j} \right)$$

$$0 = \frac{-5000}{(1+I)^0} + \frac{5800}{(1+I)^1}$$

$$I = .16$$

Thus, even though the actual amount of the return in this project is less if one finances the project, the rate of return is higher. Another way of stating the relationship of the figures in this example is that before financing, one made one thousand dollars on an investment of ten thousand and after financing one made eight hundred dollars on an investment of only five thousand dollars.

If the interest rate of the loans in this example were equal to the rate of return, then the rate of return for the financed project would have been the same as that for the unfinanced project. If the interest rate of the loans were higher than the unfinanced rate of return, the financed rate of return would have been lower.

The importance of the financing is the effect the movement of the loan into and out of the project has on the net cash movement of the investment. It must be remembered that a negative net cash movement for any year signifies a new investment. The payment of the loan must be treated as a "cash out" item which lowers the absolute amount of the return. Basically, when one is computing a rate of return, one is not interested in where the cash came from (sales or loans) or where it is going (interest, principle, or development costs) but only in the changes in absolute amounts of cash.

B. Programmed Loan Options

While the computer program does not come near to the complexity of actual real estate financing, it does include several alternative methods of entering loan information. First, any number of loans for any number of years may be entered. Second, one may enter the actual amount of a loan or else one may state that the loan is to be some percentage of any cost item in TABLE 5 or TABLE 6. Third, the interest rate of the loan may vary. Fourth, one may have principal-free years at the beginning of the loan. And fifth, the loan principal payments may be fixed or may vary up, and only up, with land sales.

Given any particular set of inputs for a loan, the program computes the repayment schedule and begins to process the next loan. Just as there are many development schemes for a particular piece of land there are many financing schemes for each development scheme. Each financing scheme is considered to be a separate loan series. When all the loans of one series have been processed, the program computes a table similar to Table IV-2 above and is called "TABLE 9 - CASH MOVEMENT WITH LOANS - SERIES XXX." The program then computes a rate of return which assumes the financing of the particular loan series it has just processed and immediately goes onto the next loan series for the same development case. There will be a separate TABLE 9 for each loan series and a separate rate of return for each loan series.

In the example in the Appendix there are two loan series. One loan series assumes that each year the developer borrows 75% of all cost for that particular year at 6% financing; the second loan series assumes the same loans but at 4% financing. Since the rate of return of the unfinanced proto-typical development was 6.4% the loans at 6% should not appreciably affect the rate of return and the loans at 4% should "leverage" up the rate of return. This is, in fact, what happens; the 6% loan series results in a rate of return of 7.4% and the 4% loan series results in a rate of return of 11.2%.

C. <u>Acceptable Rates of Return</u>

It is questionable whether the rate of return of the proto-typical example is high enough to attract the businessman's interest. While there is no hard rule as to what is an acceptable rate of return, developers have unoffically suggested that investments should double one's money every five years; that is, considering the compounding effects, investments should have an average annual rate of return of approximately 15%. Even with 4% loans, which is lower than the normal market rate of interest, the proto-typical development is short of the 15% rule-of-thumb rate of return.

The program, by an iteration process, can raise the sales prices entered in TABLE 3 one per cent per iteration until a pre-determined rate of return is reached. Once the predetermined rate of return is reached it prints out TABLE 3A - COMPUTED SALES PRICE and TABLE 9A - CASH MOVEMENTS FORCED TO XX.XX% RATE OF RETURN. In the proto-typical example, sales in the 4% loan series have to be raised 7.38% to reach a 15% rate of return and in the 6% loan series have to be raised 14.07%.

Once the computer has taken a few seconds and spewed forth the multiple pages of output, the entrepreneur must somehow weigh the risks and make his investment decision. It is possible that the process of development may be enough "fun", that is, may be so important to a particular entrepreneur, that he may be willing to enter a particular venture even if he expects a low rate of return or, in some cases, to lose money. It may be that, because of complicated tax manipulations, a loss on a large land development is part of a strategy of achieving a greater profit on a particular total company undertaking. Anything, after all, is possible. But for better or worse, by using this program or one similar to it, an entrepreneur, by knowing the expected rate of return, can see the effects a particular development plan may be expected to have on his fortunes.

Chapter V: THE STATISTICS OF THE PROGRAM

Students who undertake a research project, which, like this effort, is dependent on writing a computer program, may want to evaluate the amount of time and energy involved in such a task. It is true that no two problems are of equal complexity and no two programmers have equal skill and that programming languages seem continually to improve. Nevertheless, from the knowledge of one anothers work, we might be able to classify new computer problems by the magnitude of effort similar problems have required.

The "Large Land Investment Program" explained in this paper took me five months and three and a half hours of IBM 7094 computer time. Had I not received help from Edward P. Eichler, Director of the Community Development Project, in defining the problem that the program was to solve, it would have taken me even longer to execute the actual writing of the program. Another research group associated with the Community Development Project, which, in my opinion, did not have a clear conception of the problem, spent a year and more than ten hours of computer time without producing a workable program.

When I first started writing the program I had thought that the "model" described in Chapter II would be the important contribution of the program. I now feel that the "model" aspect of the program is interesting, but basically is no different from what has been done many times before. Rather, the most important aspect of the program as I now see it is the computation of the rate of return. The equation for the rate of return in large land investments is such as to make it unlikely that anyone would try to compute a rate of return by hand. The new ability to compute a rate of return enables one to see easily the effects of separate pieces of a development plan.

It is of interest to note that it was not until I was more than half way through the job that I even considered trying to find a rate of return. When I first conceived of the program I merely attempted to discount the net cash movement at various discount rates. But when I tried to figure out what the results of this discounting meant I realized that I should try to compute the rate of return.

From a programming point of view there are four interesting aspects of the program: 1. the ability to handle multiple sets of data in one "run" of the program through the computer; 2. the ability to compute loan repayment schedules; 3. the ability to compute a rate of return; and 4. the ability to compute a sales price schedule that will result in a predetermined rate of return. When I started writing the program, I had not planned to include any of these four items. The program just seemed to grow.

The last addition to the program, computing a sales price schedule which will result in a predetermined rate of return, took approximately six weeks and over one hour of computer time. Theoretically this part of the program should have been no harder than the earlier work, but the program had become so big that it had become much harder to find ones mistakes.

It is my opinion that, notwithstanding the time and cost, computer research problems can be worth the effort. However, one should be forewarned that anyone attempting computer research will most certainly be taught a lesson in patience.

ACKNOWLEDGEMENTS

This study was sponsored by the Community Development Project, which was established by a Ford Foundation Grant, at the Center for Planning and Development Research. I am indebted to Edward P. Eichler, Director of the Community Development Project, and John Dyckman, Director of the Center for Planning and Development Research, for the original commission of this research and for assistance and encouragement while it was being conducted. I am also indebted to Patricia Elliot for editorial assistance in completing the text. And I want to express my appreciation to Beverly Stotesbury and Janet Trujillo who did the final typing.

APPENDIX: Sample Run of The Financial Viability of The Large Land Development Program.