

# REAL ESTATE ANALYSIS VOLUME I

Catalog Number 26-1571

**Radio Shack®**  
**TRS-80**  
**MICRO**  
**COMPUTER**  
**SYSTEM**

1. Compound Interest
2. Resale Analysis
3. Stepped Income Analysis
4. Rates of Return

# Introduction

Volume I of the Real Estate Analysis series signals the entry of TRS-80 computers into the world of applications software for the Real Estate industry. In recent years, significant developments have occurred in the advancement of quantitative tools of analysis which may be applied to a broad range of real estate decision making situations. Hand held or desk calculators, programmable and non-programmable, have aided real estate investors, salesmen, brokers, lenders, appraisers, counselors, and others to better understand and more rapidly apply many of these tools. With the introduction of this Volume, and those to follow in this and other series, Radio Shack now offers a combination of the powerful computer capabilities of the TRS-80 and proven software, to provide real estate decision makers and practitioners a new dimension in real estate analysis.

Unlike even the most sophisticated calculators, there are important advantages of the computerized Real Estate Analysis system which will become apparent immediately upon "power up and load" of the TRS-80. First, there is the advantage of permanently stored programs that may be loaded for operation with a simple command. Second, all programs are "self documenting" in that they use the programming technique of conversational prompting to direct the user through each routine, avoiding the necessity to have special training or to constantly refer to separate manuals to make full use of each program. Third, the CRT screen display of the TRS-80 permits visual inspection and monitoring by the user; up to 16 lines at a time. Fourth, the programs each offer editing capabilities which allow users to easily correct entry errors, and to perform powerful sensitivity testing. Speed, accuracy, simplicity, price . . . there are many reasons why the TRS-80, with innovative applications software, offers a significant alternative to previous real estate decision making methods.

# Overview of Volume I

This volume includes four of the most important and frequently used real estate analysis routines. **COMPOUND INTEREST** calculates the six compound interest functions for any interest, rate and term, and includes a special calculation of the annualized mortgage payment factor. **RATE OF RETURN** calculates the internal rate of return for any series of annual before or after tax cash flows; it also incorporates Modified Internal Rate of Return and Financial Management Rate of Return calculations as options. **RESALE ANALYSIS** calculates the required resale price to achieve a given yield on equity investment, as well as the associated amount of property value change. **STEPPED INCOME ANALYSIS** is a special cash flow analysis routine which calculates present worth of income streams changing at a constant amount of percent.

## Limitations

The TRS-80 has a limit as to the size of the largest number it can handle. This is true of any computer. In actual use, it is almost impossible to exceed the capabilities of the TRS-80. If you enter the maximum amount allowed in each category, the answer can exceed the limits. (The old parable of doubling a penny each day, till you reach astronomical proportions.) Page A/16 of the Level II Manual contains the TRS-80's limits. The four Real Estate Programs contain an automatic Limit Control that prevents the program from "crashing" because of Exceeded Limits. If, during calculations, the numbers become too large to handle, the program automatically returns to the start of the input section. The display will print **XXXXX ANSWER EXCEEDS ACCURATE COMPUTATION RANGE XXXXX**. You can now enter lower values. Since all input data is interactive, it is impossible to list the maximum allowable value for any one input. This will depend on the other values. If you use "real world" values, i.e., typical transactions, you will probably never exceed the limits of the TRS-80.

# Real Estate Analysis

Analysis and valuation of real estate require numerous analytical processes which are time consuming, exacting, and subject to human error when accomplished by hand or by calculator. For these and other reasons, many real estate practitioners, investors, and others sometimes avoid types of analysis which, if applied, could reduce error and promote better decisions.

In recent years, various entities of the National Association of Realtors have introduced new decision making tools into their professional courses and seminars. Organizations such as the American Institute of Real Estate Appraisers, the Mortgage Bankers of America, and others, have encouraged their members to expand their knowledge and use of modern decision making tools. The growing complexity of modern real estate has been accompanied by growing capacity to make more relevant and detailed analysis of real estate situations, and an awareness that such analysis is crucial to many realty decisions.

Individuals who are not engaged in the real estate industry have also learned that real estate offers most of us our best opportunity for wealth. As a vehicle for capital appreciation, tax avoidance, security, and many other benefits, real estate has few peers. Even the single family dwelling has proved to be one of the finest available investments in most instances.

Professionals and non-professionals in real estate share common needs to better understand the facts at hand, and to know when, where and how to make decisions in real estate. With the introduction of a broad range of decision making tools into the realty field, it is no longer necessary to simply guess, or rely on intuition alone in making purchase, sale, lending, rental, investment and other decisions. Real estate analysis can be, and often is performed by the non-professional who may apply many of the same basic analysis which would be performed by the professional. These efforts, as well as those by the professionals can be greatly aided by the computer assisted analytical routines. Like medical evaluation, however, it is best to seek the advice of experts in critical situations. The old adage "garbage in - garbage out" is equally true in real estate analysis of every sort.

Most real estate decision situations may be represented in numerical form. Unfortunately, in the past it has been difficult for many to know what numbers were necessary, or what to do with them if they were at hand. Some of the most valuable analysis tools are also the most complicated, discouraging their use even by trained professionals. Many of these barriers have now been broken by intelligent use of the computer, which affords opportunity for guiding users through their considerations, as well as extraordinary speed and accuracy.

Radio Shack recognizes the need for better tools of decision making at all levels of real estate activity, and are proud to offer the public and the real estate profession a means of accomplishing better analysis and decisions.

# Operating Instructions

For TRS-80 operating instructions, refer to your TRS-80 Manual. After you load and RUN the program, follow the instructions as they appear on the screen. You will quickly learn that you have a great deal of flexibility in using these programs, particularly with their self contained Editing sections. Here is a brief description of basic operating instructions with which you should quickly become familiar.

## A. Equipment

Minimum hardware required is a 16K Level II Basic TRS-80, with cassette recorder.

## B. Powering Up

Check all TRS-80 connections to verify that each component is properly attached; press **ON** button at right rear of machine; when **MEMORY SIZE?** appears on screen, press **ENTER**.

## C. Loading Program

Insert proper cassette into recorder and press the recorder's "PLAY" lever (rewind first if this was not done in previous use of the program); DO NOT press the red "RECORD" lever except when recording programs;

1. Type **C L O A D**, and press **ENTER**.
2. When **READY >\_\_** appears on the screen, you are ready to proceed with execution of the program.

## D. Running Program

After program is loaded, simply type **R U N** and press **ENTER**; if for any reason the program did not load properly on the first attempt, you can not RUN the program; in this case, rewind the cassette, press reset button on left rear of TRS-80, and return to Step C.

## E. Program Operation

Once the program has been started in Step D, you simply follow all screen instructions by answering program input requests; the following conventions are used:

1. (.XXXXXX) indicates to enter number as a decimal; for example the number 12½ per cent would be entered as .125; trailing zeros are not necessary.
2. (+/-)\$ indicates the response should be in whole dollar amounts, but in the event that the number is negative, a minus sign should precede the number.
3. (Y or N) indicates a yes or no response is required. Enter a **Y** for yes or an **N** for no.
4. All other commands should be self explanatory.

# Glossary Of Terms

## **Advance Payments**

Rent payments which are made in advance of occupancy, and at the beginning of each occupancy period.

## **Annual Interest Rate**

Synonymous with the "nominal interest rate"; refers to the rate of interest or discount as an annual rate of return; provides the basis for calculation of a periodic rate of interest.

## **Appreciation**

Future or historical growth in the capital value of a particular investment; equity investment, for example, may appreciate at the same time the market value of real estate is declining.

## **Arrears**

Generally used in "payment in arrears"; refers to rent payments which occur at the end of an occupancy period; also refers to mortgage situations in which interest is paid for an entire payment period, with principal deducted at the end of the payment period, or "in arrears".

## **Base Rent**

Starting rent under a lease agreement; alternatively, a guaranteed minimum rent under a lease contract, upon which may be added various types of rent escalations.

## **Base, The**

The base in the basic formula for all compound interest situations:  $(1+i)^n$ ; "i" represents the periodic interest rate, and the number one represents one dollar of invested capital.

## **Beginning Of Period**

Applies to payments in which interest or rent is to be applied from the beginning of a particular period, as for example, the beginning of occupancy under a lease contract.

## **Debt Service**

Payments of principal and interest on a mortgage or trust deed.

## **Depreciation**

Loss in value, from any cause; in income or value projections, refers to decrease in capital value over a projection period.

## **Discount Rate**

Synonymous with interest rate; a simple rate of yield on any type of investment; for example, a mortgage interest rate is a discount rate for the mortgage.

**Ellwood**

A method of mortgage-equity analysis and capitalization named after the late L. W. "Pete" Ellwood; the Ellwood formulation involves somewhat complex mathematics, but is simplified by the Ellwood Tables, published by The American Institute of Real Estate Appraisers, or by computer and calculator routines.

**End of Period**

Synonymous with "in arrears"; refers to payments or interest which apply at the end of a particular income period.

**Equity Yield**

The internal rate of return before taxes on an equity investment; the discount rate at which the present worth of all incomes during ownership of an investment (including the final recapture of invested capital), exactly equals the original capital investment; the rate at which Net Present Value equals zero, and the Profitability Index equals one.

**Factor**

As used in these programs, refers to one of the compound interest factors; literally a relationship, often applied as a multiplier.

**Financial Management Rate of Return**

A modified internal rate of return concept which utilizes both a safe rate and a market rate for internal application in calculating return on an investment; see Rate of Return program.

**Graduated Income**

Income which remains level for a specified period, then moves to a different level for another specified period; often found in lease income situations.

**Interest Rate**

See Discount Rate.

**Internal Rate of Return**

Synonymous with the equity yield rate in before income tax situations, but may also apply to after tax incomes with the same principles applied to measure return on investment after taxes; see Equity Yield Rate.

**Level Income**

A pattern of income which is constant and unchanging in amount; often encountered in lease situations; sometimes adopted for convenience in income projection situations where income is "stabilized" or treated as though, on the average, it would be expected to remain level over an investment holding period.

**Loan To Value Ratio**

The ratio of loan to market value of real estate; generally controlled as a maximum by the laws governing lenders; also frequently stated in loan commitments.

**Market Rate**

As used in the Financial Management Rate of Return, that rate which is expected in the market as the typical or normal rate of return for a given investment type.

**Modified Internal Rate of Return**

A modification of the internal rate of return which provides for internal application of a "safe rate" of return to all expected negative cash flows; see full discussion in Rate of Return program.

**Mortgage**

A pledge of real property as security for a promissory note to repay an indebtedness; although legal concepts vary among states, generally synonymous with the term "Trust Deed".

**Net Operating Income**

The income which is net from real estate operations after deducting from gross income allowances for vacancies and credit losses and all real estate expenses; net operating income is an important first level of income for most income capitalization processes.

**Net Present Value**

The result of deducting the amount of capital outlay for a particular investment from its present worth measured at a given discount rate; in theory, investors will generally expect a net present value of at least zero, but attempt to purchase so as to achieve a positive net present value.

**Nominal Interest Rate**

Synonymous with the Annual Interest or Discount Rate.

**Overall Rate**

Also known as the Overall Capitalization Rate; the rate expresses the direct relation between net operating income and price or value, and is a commonly used rate for capitalization of income into a value indication; derived by dividing net operating income by price or value.

**Periodic Rate**

The rate of interest per period; calculated by dividing the annual (nominal) interest rate by the number of payments per year, or by the number of compounding periods per year; sometimes referred to as the "effective rate of interest", but is not synonymous with the "Annual Percentage Rate" used in consumer finance.

**Present Worth**

Synonymous with Present Value; the worth at a given time of benefits expected to be received in the future; may also be applied to obligations to calculate a negative present worth.

**Profitability Index**

The present worth of an investment divided by the amount of capital outlay required to acquire the investment; in investment theory, investors strive for a profitability index of at least one or more; the measure permits comparison of investments which different amounts of capital outlay required.

**Projection Period**

A specific forecast or holding period for an investment; in the analysis of income producing real estate, it is generally necessary to select a specific future time period for income and future value projections. This time frame is called the projection period.

**Reversion**

A receipt of property or capital at a future time; at the end of a lease, the real property rights transferred by the lease are said to "revert" to the original owner; reversion of invested capital occurs at the time of sale of the investment, and may be equal to, more than, or less than the original investment.

**Safe Rate**

The rate of interest which can be earned on the safest class of investment at a given time; often equated with the rate being paid on certain types of U.S. Government securities.

**Sensitivity**

Sensitivity testing is a real estate and investment analysis technique in which the chances for and consequences of change are tested by repeated modifications to the data studied.

**Stabilized Income**

Income which is presumed to be, or which is treated as though, level over a projection period; net operating income is sometimes treated as a stabilized income where both incomes and expenses are changing in the same direction and seem to be offsetting one another.

**Stepped Income**

Income which varies upwards or downward on a regular periodic basis; the steps of income may be calculated on a dollar basis or on a percentage basis from a known starting point.

**Trust Deed**

As used herein, essentially synonymous with the term "Mortgage".

**Value**

The worth of something to someone; in real estate it is customary to state a particular type of value, as "market value", "investment value", "value in use", and the like; each type of value has a separate and distinct meaning, and should not be used interchangeably with other types of value.

**Variable Income**

An income pattern which varies irregularly; while stepped and graduated income streams are technically variable incomes, the term is normally reserved only for irregular changes.

**Yield**

Return on investment; yield may be measured in numerous ways, as for example, "equity yield", "mortgage yield", yield on a leasehold position, and the like.

# Compound Interest

## (The Functions of a Dollar at Interest)

### Program Overview

Compound Interest, as contrasted with simple interest, is based upon the concept that there is a time value of money which allows for compounding of interest on principal invested over time. The basic compound interest formula  $(1+i)$  is said to be "the base", and is found in all compound interest functions. The number 1 represents one dollar of principal, and the letter  $i$  represents interest for one interest earning period. The compound interest functions included in this program and their basic formulas are as follows:

- 1. Amount of One (or Future Worth of One)**  
The amount to which one dollar of invested capital will grow over a stated time at a stated rate of interest.  $S^n = (1+i)^n$
- 2. Amount of One Per Period (or Future Worth of One Per Period)**  
The amount to which a continuous series of one dollar investments will grow over a stated time at a stated rate of interest.  $S_{\overline{n}|i} = (S^n - 1)/i$
- 3. Sinking Fund Factor**  
The amount which must be continuously invested periodically over a stated time at a stated rate of interest to accumulate \$1.00 at a given future date.  $1/S_{\overline{n}|i} = i/(S^n - 1)$
- 4. Present Worth of One Dollar (Reversion Factor)**  
The present worth of the right to receive \$1.00 at a given future date with periodic compounding of interest at a stated rate.  $V^n = 1/S^n$
- 5. Present Worth of One Per Period (Inwood Factor)**  
The present worth of the right to receive \$1.00 per period over a given time, with periodic compounding of interest at a stated rate.  $a_{\overline{n}|i} = (1 - (1/S^n))/i$
- 6. Partial Payment Factor (Installment to Amortize \$1.00)**  
The periodic amount, including principal and interest, which must be paid at a given rate of interest over a given time, to interest.  $1/a_{\overline{n}|i} = i/(1 - (1/S^n))$
- 7. Annualized Partial Payment Factor for Monthly Compounding**  
The conceptual equivalent of the Partial Payment Factor, but specifically calculated for monthly compounding, with the monthly factor then multiplied by 12; used frequently in mortgage situations, particularly in cash flow and equity studies.  $(1/a_{\overline{n}|i} \text{ for monthly compounding}) \times 12$

## Applications

Many analysts, investors, and real estate practitioners own and frequently use printed compound interest tables. Even the finest tables, however, do not contain all compound interest situations, and are often time taking to search and interpret. Because there are generally many numbers from which to choose, extraction of numbers from pre-printed tables is subject to human error. Hand held calculators are an improvement, but many require special preparation for calculations and few permit simple editing for repeat calculations. Only computers offer full screen display of both inputs and outputs as well as hardcopy options.

### Screen Shows:

### You Type:

ANNUAL INTEREST (Discount) RATE ..... (.XXXXXX)  
LENGTH OF ANALYSIS PERIOD ..... YEARS \_\_\_\_ MONTHS \_\_\_\_  
NUMBER OF PAYMENTS PER YEAR ..... (Number)

### Screen Shows:

(Summary of All Input Data):

Listing of Six Compound Interest Functions and Results:

1. AMOUNT OF ONE
2. AMOUNT OF ONE PER PERIOD
3. SINKING FUND FACTOR
4. PRESENT WORTH OF ONE (REVERSION)
5. PRESENT WORTH OF ONE PER PERIOD
6. PARTIAL PAYMENT
7. ANNUALIZED PARTIAL PAYMENT FACTOR

Editing (Sensitivity Option)

This program provides opportunity to rapidly calculate any compound interest function, and to quickly recalculate where repetitive tests may be needed.

### EXAMPLES:

#### 1. Amount of One

If \$100 is deposited at 7.5 percent annual (nominal) rate of interest, with interest compounding monthly, how much will accumulate over six and one-half years?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....   
ANY CORRECTIONS (Y OR N)? .....

**Screen Shows:**

AMOUNT OF ONE ..... 1.615675

$\$100 \times 1.615675 =$  ..... \$161.57

**2. Amount of One Per Period**

If \$100 is deposited quarterly at 7.5 percent annual (nominal) rate of interest, how much will accumulate over a 10 year period?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

AMOUNT OF ONE PER PERIOD ..... 58.791898

$\$100 \times 58.791898 =$  ..... \$5879.19

**3. Sinking Fund Factor**

If \$1000 is needed in 8 years and 8 months, how much must be deposited monthly to accumulate that total amount (principal and interest) if the annual (nominal) rate of interest is 6 percent?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

SINKING FUND FACTOR ..... .006695

$\$1000 \times .006695 =$  ..... \$6.70

**4. Present Worth of One (Reversion)**

A contract calls for a single lump sum payment of \$1000 due 12 years and 3 months from now. What is the present worth of the right to receive this payment with monthly compounding and an annual (nominal) rate of 8 percent?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

PRESENT WORTH OF ONE (REVERSION) ..... .376536

$\$1000 \times .376536 =$  ..... \$376.54

**5. Present Worth of One Per Period**

A contract calls for 14 years and 6 months of payments at \$100 each half year. What is the present worth of the right to receive these payments and semi-annual compounding and an annual (nominal) rate of 9½ percent? (All payments are "in arrears" rather than "in advance".)

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

PRESENT WORTH OF ONE PER PERIOD ..... 15.571864

$\$100 \times 15.571864 =$  ..... \$1557.19

**6. Partial Payment Factor**

What monthly payment is required to provide debt service (principal and interest) on a \$1000 loan at 8¾ percent interest, to be repaid in monthly installments over 4 years and 6 months?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

PARTIAL PAYMENT FACTOR ..... .022470

\$1000 × .022470 = ..... \$22.47

**7. Annualized Partial Payment Factor**

An apartment building was purchased with a \$200,000 mortgage at 9¼ percent interest, with monthly payments over a full term of 25 years and 6 months; what is the annual debt service amount to be paid from the property's net operating income?

**Screen Shows:**

**You Type:**

ANNUAL INTEREST RATE .....   
LENGTH OF ANALYSIS PERIOD ..... YEARS  MONTHS   
NUMBER OF PAYMENTS PER YEAR .....

**Screen Shows:**

ANNUALIZED PARTIAL PAYMENT ..... .102255

\$200,000 × .102255 = ..... \$20,451

**Special Instructions**

- A. Remember not to use commas between numbers except when entering two or more entries per line; thus 200,000 would be 200000. The special entry routine used will accept numbers with commas in most instances without damaging the results, but it is good practice to enter numbers without commas.
- B. The editing feature of this program is provided for correction of erroneous entries, and for repeated runs where only one or possibly two inputs may be varied. This "sensitivity testing" option is one of the program's most powerful features.
- C. Because the compound interest calculations are all built upon the formula  $(1 + i)$ , it is important to remember the difference between an annual (nominal) rate of interest and the periodic rate; in the formula, "i" is the periodic rate; the nominal rate divided by the number of compounding periods per year.
- D. Present Worth of One Per Period tables are normally constructed for "end of period" payments, commonly referred to as payments "in arrears". Most rental payments, however, are "in advance" with the first payment due at the beginning of an occupancy period. There are numerous methods of converting the end of period factor (as calculated

by this program), to a beginning of the period factor. Perhaps the easiest is to multiply the calculated factor times "the base". The base is simply the periodic rate of interest added to the number one. With an annual interest rate of 12% for example, the periodic rate is calculated by dividing the annual interest rate by the number of payments per year:

PAYMENT FREQUENCY	PAYMENTS/YEAR	PERIODIC RATE	THE BASE
Annual	1	$.12/1 = .12$	1.12
Semi-Annual	2	$.12/2 = .06$	1.06
Quarterly	4	$.12/4 = .03$	1.03
Monthly	12	$.12/12 = .01$	1.01

In example 5 above, the present worth of a 14 year 6 month contract calling for semi-annual payments of \$100 and discounted at 9½ percent was calculated as \$1557.19. If the payments are in advance, the percent worth conversion using the base formula would be applied as follows:

Present worth, payments in arrears .....	\$1557.19
Multiply times "the base"	
$1 + (.095/2) = 1 + .0475 =$ .....	$\times 1.0475$
Present worth, payments in advance .....	\$1631.16

It is important to remember that the base should not be multiplied times the present worth of the final reversion. The reversion occurs at the end of all payments, and should not be influenced by whether regular payments were in advance or in arrears.

## Print Option

After screen display of results, the question ANY CORRECTIONS (Y OR N)? is asked to permit correction or repeated screen variation. Then, WOULD YOU LIKE A PRINTED COPY OF THIS ANALYSIS (Y OR N)? is asked. If your printer is turned on, ☒ produces a printed copy, and ☐ returns to the start of the program.

# Resale Analysis

## (Future Price Required For a Given Yield)

### Program Overview

In the original purchase of an investment, many investors seek a given rate of return on their equity investment. If they can satisfy themselves that they have reasonable prospects for earning that equity rate of return, and if other criteria can be met, a project is often said to be "feasible" to that investor.

It is important to note, however, that it is not unusual for investors to look only to cash flow returns as a measure of investment profitability. While cash flows are a significant element of any investment, the true rate of return on investment is not measured on cash flows alone—the final return of invested capital (reversion) is also needed. Thus, the price at which an investment sells, or for which it may be sold in the future, is a critical part of the total analysis.

This program provides a means of calculating the required future resale price to achieve a stated rate of equity yield, together with the requisite change in value from the original price of the total investment, and the mortgage balance at time of sale. The program assumes level annual net operating income over the projection period.

In addition to its applicability in analyzing investment opportunities, this program is important in decisions to sell, exchange, and the like. Actual historical data may be entered, and resale (or exchange) prices tested for their effect on the investor's internal rate of return. Sensitivity testing may also be applied to test the consequences of various possible courses of action.

Internally, this program uses the popular Ellwood formula to calculate various financial relationships, and to apply the stated rate of yield to calculation of results. Special inputs usually required for the Ellwood formula are automatically calculated, and only simple inputs are required.

### Screen Shows:

### You Type:

PURCHASE PRICE OR VALUE .....	(Dollars)
NET OPERATING INCOME .....	(Dollars)
EQUITY YIELD REQUIREMENT .....	(.XXXXXX)
PROJECTION PERIOD .....	YEARS ____ MONTHS ____
MORTGAGE LOAN TO VALUE RATIO .....	(.XXXXXX)
MORTGAGE INTEREST RATE .....	(.XXXXXX)
TERM OF THE MORTGAGE .....	YEARS ____ MONTHS ____
NUMBER OF MORTGAGE PAYMENTS PER YEAR .....	(Number)

**Screen Shows:**

**You Type:**

OVERALL RATE .....	(.XXXXXX)
MORTGAGE BALANCE .....	(Dollars)
REQUIRED APPRECIATION OR DEPRECIATION .....	(.XXXXXX)
REQUIRED RESALE PRICE .....	(Dollars)

## Applications

In addition to those comments in the OVERVIEW it is important to note that there is a direct relationship between resale price and equity yield, given a net operating income (before mortgage debt service) and specific mortgage requirements. With the cash flow which is left to the equity investor after payment of debt service (or if there is a negative cash flow, as when net operating income is insufficient to cover debt service), it is necessary to test the effect on yield of a specific resale price, or possibly a series of possible resale prices.

Likewise, a part of risk analysis for the investor, analyst, broker, or others, is to view the required property value change to accomplish a target or general market rate of equity investment return. If the required resale price and associated property value change are higher than the expected change in market price, there is greater risk in achieving a stated yield. If the required resale price is lower than the market expectation, there appear to be better prospects of achieving the stated goal.

Outputs in this program also reflect the results of other calculations which are internally consistent with given inputs. The mortgage balance is calculated for the mortgage interest, term, and periodicity of payments. The overall capitalization rate is based upon the Ellwood premise of mortgage and equity relationships for the given mortgage, equity yield, and projection period. By repeated sensitivity test runs, the effects of change may be tested on any or all input variables.

### EXAMPLE:

An investment can be purchased for \$150,000. Its stabilized net operating income over a 10 year projection period is expected to be \$12,000 per year. A mortgage of 75 percent of the purchase price is available with annual interest of  $9\frac{1}{4}$  percent, amortized in monthly payments over 27 years and 8 months. What resale price must occur for the investor to earn a 15 percent before tax yield (IRR) on the equity investment?

**Screen Shows:****You Type:**

PURCHASE PRICE OR VALUE .....	1	5	0	0	0	0
NET OPERATING INCOME .....	1	2	0	0	0	0
EQUITY YIELD REQUIREMENT .....	.	1	5			
PROJECTION PERIOD .....	YEARS	1	0	MONTHS	0	
MORTGAGE LOAN TO VALUE RATIO .....	.	7	5			
MORTGAGE INTEREST RATE .....	.	0	9	2	5	
TERM OF THE MORTGAGE .....	YEARS	2	7	MONTHS	8	
NUMBER OF MORTGAGE PAYMENTS PER YEAR .....		1	2			
ANY CORRECTIONS (Y OR N)? .....						N

**Screen Shows:**

OVERALL RATE .....	.08000
MORTGAGE BALANCE .....	\$98,074
REQUIRED APPRECIATION OR DEPRECIATION .....	.568878
REQUIRED RESALE PRICE .....	\$235,332
ANY CORRECTIONS (Y OR N)? .....	N

**NOTE:**

This program was designed only for level net operating income streams, but uneven or variable income streams may be treated by approximation by entering the average annual net income. The results will likewise be approximations, except for the mortgage balance.

If further testing is required, the ANY CORRECTIONS routine can be used for repeated changes. For example, to test the inputs for a 12% yield:

ANY CORRECTIONS (Y OR N)? .....	Y
WHICH ONE (1-8) .....	3
EQUITY YIELD REQUIREMENT .....	.12
ANY CORRECTIONS (Y OR N)? .....	N
OVERALL RATE .....	.08000
MORTGAGE BALANCE .....	\$98,074
REQUIRED APPRECIATION OR DEPRECIATION .....	.347021
REQUIRED RESALE PRICE .....	\$202,053

**Print Option**

If the printer is attached and turned on, a print option will be given after answering the final ANY CORRECTIONS (Y OR N)? . See the Compound Interest documentation for a full explanation of using this option.

# Stepped Income Analysis

## (Present Worth of Regularly Increasing or Decreasing Income)

### Program Overview

Net operating income from investment is perhaps the most important property income for general analysis, and the cash flow to the equity position is generally considered the most important before tax income level for studying the equity investor's position. This program will analyze either of these types of income, or incomes from other types of investment.

Level incomes may be analyzed in other Real Estate Analysis library programs, but some incomes may be expected (or required by contract) to vary regularly. This program considers the effects of income streams which vary at regular intervals over given time periods. Either changes by constant dollar amounts or changes by constant percentage amounts, or both, may be calculated. In addition to calculating the specific projections of income, the program also will calculate the present worth of projected incomes, including reversion if any, and provide a total expected present worth of all projected amounts.

While any projection of future incomes (other than those required by specific contract) requires forecasting, there are often trends in evidence from which expectations may be drawn. In analyzing investor behavior, it is not necessary to say that future income will be exactly a certain amount; instead it is more appropriate and more significant to say that investors are currently evidencing that they are acting as though the future will likely occur in a certain way. This program allows analysis of forecasts, and the opportunity to test current prices against possible income change presumptions.

Stepped income analysis is one of several income analysis modules in the Real Estate Analysis library. It offers numerous sensitivity testing options and three different display options for the computed results.

### Program Screen Shows

SELECT ONE OF FOLLOWING OPTIONS FOR FREQUENCY  
OF PAYMENTS:

- |                       |                         |
|-----------------------|-------------------------|
| 1. MONTHLY PAYMENTS   | 3. SEMI-ANNUAL PAYMENTS |
| 2. QUARTERLY PAYMENTS | 4. ANNUAL PAYMENTS      |

OPTION (1-4)

NUMBER OF PAYMENT PERIODS

(Total Number of Payments to be Made or Received).....**(Number)**

SELECT ONE OF FOLLOWING OPTIONS FOR PAYMENT METHOD:

1. BEGINNING OF PERIOD PAYMENTS
2. END OF PERIOD PAYMENTS

OPTION (1-2)?

SELECT ONE OF FOLLOWING OPTIONS FOR PAYMENT METHOD:

BASE RENTAL AMOUNT (Starting Periodic Rent or Income).....(**Dollars**)

NUMBER OF PERIODS BETWEEN INCOME VARIATIONS

(Number of Successive Payments Before Dollar  
or Percent Change).....(**Number**)

DOLLAR AMOUNT OF VARIATION (Periodic Change in  
Constant Dollar Amount).....(**Dollars**)

PERCENT VARIATION (Periodic Change in Constant  
Percentage Amount).....(**.XXXXXX**)

REVERSION AMOUNT (Lump Sum Capital Reversion, if any).....(**Dollars**)

ANNUAL DISCOUNT RATE (Desired Amount Rate of Return  
on the Income Stream).....(**.XXXXXX**)

ANY CORRECTIONS (Y OR N)? ..... (**Y or N**)

SELECT ONE OF FOLLOWING OPTIONS:

1. COMPLETE LISTING OF ANALYSIS
2. ANNUAL LISTING OF ANALYSIS
3. PRESENT WORTH OF INCOME STREAM AND REVERSION (if any)
4. CORRECT INPUT VALUES
5. PERFORM A NEW ANALYSIS

OPTION (1-5)?

## **Options**

### **Option 1**

Presents periodic rent amounts and their respective present worths with 12 periods displayed per screen module; after all incomes have been displayed, present worths of level and compound variations are displayed.

### **Option 2**

Presents annual listings of rent amounts and their respective present worths; after all incomes have been displayed, present worths of level and compound variations are displayed.

### **Option 3**

Presents a simple summary of the present worths of level and compound variations of income.

### **Option 4**

Corrections, or sensitivity variations can be made through a special editing routine.

### **Option 5**

Returns the program to its starting point.

## Applications

Certain types of leases are written with automatic rent escalation clauses. Other types of income may be viewed as changing at regular dollar or percent amounts. This program is adaptable to these and numerous other situations.

It is also possible to apply this program to the projection of any type of trended numbers. Not only may the routines be applied to each category of income and/or expense, but population, sales, or other data may be substituted and the present worth calculations simply ignored.

Many individuals tend to think in compound rate changes in many market activities. An advantage of this program is the opportunity to compare constant dollar changes with possible percent changes. By seeing the effects of continued percentage change, a user of this program can test the reasonableness of market activity representations, and the consequences of continued change at given rates or dollars.

Among the many other applications of this program, it is also possible to test market trends in real estate sales by comparing present worths developed from this program's calculations against sales prices of investment real estate. Current market prices reflect investor attitudes towards future cash flow and resale expectancies. Various combinations of income changes and reversion changes may be tested for market fit, and for most reasonable market explanation or simulation.

### EXAMPLE:

A lease is being negotiated between your client and a prospective tenant. They have agreed that the base rental will be \$2000 per month for the first year of a 10 year lease, but the tenant offers \$200 per month increase in the rental amount each year as opposed to your client's proposal that the rent increase be 10 percent on each lease anniversary. Your client wants a return of 11 percent on invested capital, and has \$325,000 invested in the property. All incomes will be absolutely net to the investor, and are after debt service on the mortgage. You anticipate that a nominal growth in the equity investment will occur over the 10 year lease, and that a \$325,000 value is a reasonable expectancy. Will either of the two rent escalation proposals accomplish your client's basic investment return requirement? (Rent is to be paid "in advance").

**Screen Shows:****You Type:**

SELECT ONE OF THE FOLLOWING OPTIONS FOR FREQUENCY OF PAYMENTS:

1. MONTHLY PAYMENTS
2. QUARTERLY PAYMENTS
3. SEMI-ANNUAL PAYMENTS
4. ANNUAL PAYMENTS .....

**1**

NUMBER OF PAYMENT PERIODS .....

**1 2 0**

SELECT ONE OF THE FOLLOWING OPTIONS FOR PAYMENT METHOD:

1. BEGINNING OF PERIOD PAYMENTS
2. END OF PERIOD PAYMENTS .....

**1**

BASE RENTAL AMOUNT .....

**2 0 0 0**

NUMBER OF PAYMENT PERIODS BETWEEN INCOME VARIATIONS .....

**1 2**

DOLLAR AMOUNT OF VARIATION (+/-) .....

**2 0 0**

PERCENT VARIATION (+/-) .....

**. 1**

REVERSION AMOUNT .....

**3 5 0 0 0 0**

ANNUAL DISCOUNT RATE .....

**. 1 1**

ANY CORRECTIONS (Y OR N)? .....

**N**

SELECT ONE OF THE FOLLOWING OPTIONS:

1. COMPLETE LISTING OF ANALYSIS
2. ANNUAL LISTING OF ANALYSIS
3. PRESENT WORTH OF INCOME STREAM AND REVERSION
4. CORRECT INPUT VALUES
5. PERFORM A NEW ANALYSIS (OPTION 1-5) .....

**2****Screen Shows:**

PERIOD	(DOLLAR VARIATIONS)		(COMPOUND VARIATIONS)	
	PAYMENT	PRES. VAL	PAYMENT	PRES. VAL
12	\$24,000	\$22,837	\$24,000	\$22,837
24	\$26,400	\$22,515	\$26,400	\$22,515
36	\$28,800	\$22,014	\$29,040	\$22,198
48	\$31,200	\$21,375	\$31,944	\$21,885
60	\$33,600	\$20,632	\$35,138	\$21,577
72	\$36,000	\$19,813	\$38,652	\$21,273
84	\$38,400	\$18,942	\$42,517	\$20,973
96	\$40,800	\$18,038	\$46,769	\$20,677
108	\$43,200	\$17,118	\$51,446	\$20,386
120	\$45,600	\$16,195	\$56,591	\$20,099

PRESS **ENTER** TO DISPLAY TOTALS

PRESENT WORTH OF INCOME STREAMS:

LEVEL INCOME VARIATIONS .....	\$199,479
COMPOUND INCOME VARIATIONS .....	\$214,418

PRESENT WORTH OF REVERSION:

\$350,000 × .334542 .....	\$117,090
---------------------------	-----------

PRESENT WORTH OF INCOME STREAMS + REVERSION:

LEVEL INCOME VARIATIONS .....	\$316,569
COMPOUND INCOME VARIATIONS .....	\$331,507

The result of these calculations indicates that the present worth of the level income variations (including reversion) is \$316,569, which is not enough to meet the client's investment objective of an 11 percent return on equity investment. The objective would be met by the client's proposal for a percentage variation. Both results, however, are predicated upon an increase in the equity value to \$350,000 over the 10 year lease period.

Additional testing or corrections can now be made by answering the ANY CORRECTIONS (Y OR N) question with an ☐ N. Similarly, it is possible to view results by screen display, then select a hardcopy option if a printer is attached to the system.

## Print Option

After screen display of results, the question ANY CORRECTIONS (Y OR N)? is asked to permit correction or repeated screen variation. Once this question is answered ☐ N, the question WOULD YOU LIKE A PRINTED COPY OF THIS ANALYSIS (Y OR N)? is asked if your printer is attached and turned on. ☐ Y produces a printed copy, and ☐ N returns control to the start of the program.

# **Rates of Return**

## **(Three Measures of Return on Investment)**

### **Program Overview**

Investors and analysts of virtually any type of investment property are concerned with the property's rate of earnings as a relation to the original amount of investment. There are numerous types of measurements just as there are many names for the methods of measurement. In recent years, terms such as the internal rate of return, yield, equity yield, before or after tax yield, and similar terms have been broadly used. It is important to the use of such terms that the user know specifically what type of return is needed in a particular situation, and that the calculations be accurately performed.

This program calculates any of three types of measures of return on investment: the regular Internal Rate of Return (before or after taxes, depending upon the inputs)—IRR; the Modified Internal Rate of Return—Modified IRR; and the Financial Management Rate of Return—FMRR. Each is available to the user by selection from options presented once the program is loaded and prepared for operation.

The regular IRR is based upon the concept that the rate of return on investment is that rate at which the present worth of all future cash flows, including the net cash flow upon resale, is exactly equal to the original capital outlay. Thus the investment's Net Present Value (Present Worth at the IRR minus capital outlay) is equal to zero, and the Profitability Index (Present Worth at the IRR divided by the original capital outlay) is equal to one. The concept of the "internal" rate is that it is a rate which is internal to the investment until it is sold, as differentiated with an "external" rate such as cash flow rate, or measure of current yield.

A property of the IRR is the presumption of opportunity to reinvest periodic receipts of income at the same rate of yield being earned on the investment being analyzed. Because many hold that this is unlikely for most investors, different measures of return which allow presumption of a different reinvestment rate have grown in popularity. The Modified IRR and FMRR are two examples of such yield rates which offer certain other advantages over many applications of the regular IRR.

This program allows analysis of income and calculation of the selected type of yield rate for any type income stream, and permits specific entry of original capital outlay and the final net capital reversion to the investor. The reversion is presumed to be the final cash flow. All cash flows are entered on an annual basis, and are presumed to be received at the end of each year. Whether the rate of return calculated is "before or after taxes" is determined from the source of the input data.

**Screen Shows:****You Type:**

CALCULATION METHOD ..... (1, 2 or 3)  
INITIAL CASH INVESTMENT ..... (Dollars)  
NUMBER OF CASH FLOWS ..... (Number)  
CASH FLOWS FOR EACH YEAR ..... (Dollars)  
REVERSION AMOUNT (IF ANY) ..... (Dollars)  
ANY CORRECTIONS (Y OR N)? ..... (Y or N)

**Additional Input For Modified IRR:**

SAFE RATE ..... (.XXXXXX)

**Additional Inputs For FMRR:**

SAFE RATE ..... (.XXXXXX)  
MARKET OR OPPORTUNITY RATE ..... (.XXXXXX)

## Applications

Investors in real estate normally receive cash from the investment during their ownership, then a net amount of cash from the sale proceeds. A return on investment other than a cash flow rate cannot be calculated until sale. Prior to that time only prospects for yield on investment may be estimated.

At the time of purchasing an investment, it is possible to make an estimate of the expected (or contract) cash flows, both before and after income taxes. With an estimate of probable (or possible) resale price of the investment, it is then possible to calculate the rate of return which is consistent with the expected cash flows and reversion. This rate is often used as a test rate in decision making, to see whether it meets minimum objective of the investor, and as a comparator for choosing among investment alternatives. Although there are notable pitfalls in such applications, this use is widespread and broadly understood.

Owners of investments, analysts and others often use the internal rate of return measurements during ownership to test whether the investment appears to be meeting minimum investment objectives, and as a means of helping to make resale, remodeling, exchange, and other investment decisions. Again, the internal rate of return concept is only one possible decision point, but can be quite effective as a tool in monitoring the management of an investment.

Upon sale of an investment, the internal rate of return concept may be applied to determine the investor's actual yield on the investment to maturity. While historical yields are of importance to a liquidating investor, they may be of little or no practical benefit in making current market decisions.

In using the three rate of return modules in this program it is important to understand the basic operation of the program. The initial cash investment is entered as a **POSITIVE** entry, but is considered internally to be a **NEGATIVE** cash flow. The system requires that some initial outlay of capital be made, and presumes that the outlay occurs at **TIME PERIOD ZERO**. This means that the "rate of return clock" begins running with the initial capital outlay. Cash flows for each year may be entered as positive or negative amounts, but only the minuses must be keyed as the system presumes all other amounts are positive.

The reversion (if any) is presumed to occur as the final cash flow at the end of the final period. The timing of its receipt will coincide with that of the final annual cash flow, so the reversion amount may, at the user's option, either be included with the final cash flow or entered separately in response to the computer's prompting question. If entered with the final annual cash flow, you may either enter a zero or press **ENTER** as a response to the computer's **REVERSION** amount question.

Examples of program applications follow:

**A. Regular Internal Rate of Return**

An investor paid \$20,000 for an equity investment in real estate.

Over a 5 year holding period, the annual equity cash flows were:

Year 1	-\$3,000
Year 2	5,000
Year 3	2,000
Year 4	3,000
Year 5	4,000

At the end of the 5th year, the investment was sold for \$15,000. What internal rate of return (equity yield rate) did the investor earn?

**Screen Shows:**

**You Type:**

CALCULATION METHOD .....	<div style="border: 1px solid black; padding: 2px;">1</div>
INITIAL CASH INVESTMENT .....	<div style="border: 1px solid black; padding: 2px;">20000</div>
NUMBER OF ANNUAL CASH FLOWS .....	<div style="border: 1px solid black; padding: 2px;">5</div>
CASH FLOW FOR PERIOD 1 .....	<div style="border: 1px solid black; padding: 2px;">-3000</div>
CASH FLOW FOR PERIOD 2 .....	<div style="border: 1px solid black; padding: 2px;">5000</div>
CASH FLOW FOR PERIOD 3 .....	<div style="border: 1px solid black; padding: 2px;">2000</div>
CASH FLOW FOR PERIOD 4 .....	<div style="border: 1px solid black; padding: 2px;">3000</div>
CASH FLOW FOR PERIOD 5 .....	<div style="border: 1px solid black; padding: 2px;">4000</div>
REVERSION AMOUNT .....	<div style="border: 1px solid black; padding: 2px;">15000</div>
ANY CORRECTIONS (Y OR N)? .....	<div style="border: 1px solid black; padding: 2px;">N</div>

REGULAR INTERNAL RATE OF RETURN ..... 5.853%

**NOTE:**

Where multiple shifts of positive to negative or negative to positive occur, the problem is capable of multiple arithmetic results. This is a difficulty of the regular IRR concept which is described in numerous current texts and articles.

**B. Modified IRR**

This rate of return concept employs the presumption that prudent money management will assure that capital is available for capital outlays by accumulating the needed capital in a safe, highly liquid separate investment earning at a "safe" rate of interest. (Or at least there is the opportunity to do so). After discounting, the initial capital outlay, and all future negative cash flows, at this safe rate, the Modified IRR adds the present worth of the negative cash flows to the original investment, then calculates the rate of return based upon all remaining positive cash flows.

**EXAMPLE:**

An investor acquired a share of ownership in a land development project for \$60,000. After tax cash flows were as follows:

Year 1	-\$7,000
Year 2	2,000
Year 3	-15,000
Year 4	100,000

There was no separate "reversion" as the \$100,000 received at the end of year 4 completely terminated the investor's interest in the project. The safe rate for reinvestment of capital available to the investor was 5 percent. What is the indicated Modified IRR?

**Screen Shows:**

**You Type:**

CALCULATION METHOD .....	<input type="text" value="2"/>
INITIAL CASH INVESTMENT .....	<input type="text" value="60000"/>
NUMBER OF ANNUAL CASH FLOWS .....	<input type="text" value="4"/>
CASH FLOW FOR PERIOD 1 .....	<input type="text" value="-7000"/>
CASH FLOW FOR PERIOD 2 .....	<input type="text" value="2000"/>
CASH FLOW FOR PERIOD 3 .....	<input type="text" value="-15000"/>
CASH FLOW FOR PERIOD 4 .....	<input type="text" value="100000"/>
REVERSION AMOUNT .....	<input type="text" value="0"/>
SAFE RATE .....	<input type="text" value=".05"/>
ANY CORRECTIONS (Y OR N)? .....	<input type="text" value="N"/>

MODIFIED INTERNAL RATE OF RETURN ..... 6.4564%

**NOTE:**

The same answer would be calculated if the \$100,000 Cash Flow for Period 4 had been say \$50,000 with the remaining \$50,000 entered as the Reversion.

**C. Financial Management Rate of Return**

The FMRR was developed in 1973 by Chapman Findlay and Steven D. Messner in a stated attempt to respond to market expectations and to overcome observed shortcomings of the regular IRR. The FMRR is applied to cash flows from an investment after payment of mortgage debt service (principal and interest) and income taxes. The FMRR presumes availability of a safe after tax rate of return, and an opportunity to earn a higher "better than average" after tax return on other investments with risk comparable to that of the investment being analyzed. By using both these rates, the investor is provided a means of using observable market rates for basic inputs, and may have a more realistic view of return on a particular investment.

**EXAMPLE:**

Using the same inputs and givens as stated in the previous example, the investor finds that, in addition to the 5 percent safe rate, a 10 percent market rate is available on investments of similar risk. What is the indicated Financial Management Rate of Return?

**Screen Shows:**

**You Type:**

CALCULATION METHOD .....	3
INITIAL CASH INVESTMENT .....	60000
NUMBER OF ANNUAL CASH FLOWS .....	4
CASH FLOW FOR PERIOD 1 .....	-7000
CASH FLOW FOR PERIOD 2 .....	2000
CASH FLOW FOR PERIOD 3 .....	-15000
CASH FLOW FOR PERIOD 4 .....	100000
REVERSION AMOUNT .....	0
SAFE RATE .....	.05
MARKET RATE .....	.1
ANY CORRECTIONS (Y OR N)? .....	N

**Screen Shows:**

FINANCIAL MANAGEMENT IRR ..... 6.4734%

## Special Comments

Although negative rates of return are theoretically possible, they are not supported by these modules, as they are considered of little practical significance in real estate decisions.

There are presently available a number of varying calculation methods referred to as the "Modified IRR". The formula used in this program applies the safe rate only to negative cash flows, under the presumption that the risk of capital outlays is less than the risk of capital receipts.

## Print Option

After screen display of results, the question ANY CORRECTIONS (Y OR N)? is asked to permit correction or repeated screen variation. Once this question is answered ☐N, the question WOULD YOU LIKE A PRINTED COPY OF THIS ANALYSIS (Y OR N)? is asked. ☐Y produces a printed copy, and ☐N returns control to the start of the program.



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NOTE: Good data processing procedure dictates that the user test the program, run and test sample sets of data, and run the system in parallel with the system previously in use for a period of time adequate to insure that results of operation of the computer or program are satisfactory.

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