Using Present Value Analysis

By Wayne E. Etter

In a previous Instructor's Notebook, the basic idea of present value was presented along with some of the attributes that cause present value analysis to be used for analyzing investments.

- All cash flows during the life of the investment are considered. This includes the investment outlay, both positive and negative operating cash flows and appreciation.
- The timing of all cash flows is considered. Present value analysis makes those projects with delayed investment outlays or those producing cash flows sooner more attractive than those projects with immediate investment outlays or those producing delayed cash flows.
- Present value analysis considers an investor's desire to reinvest the cash benefits derived from the investment.

Present value analysis is used to determine a project's acceptance or rejection by calculating a proposed investment's net present value and internal rate of return. This Instructor's Notebook focuses on the investor's required rate of return and these two present value techniques.

An investor uses different required rates of return for different investments because the risk of all investments is not the same; normally, as the level of risk increases, the required rate of return is increased. Although risk considerations are beyond the scope of this article, it is necessary to understand only that an investor establishes a required rate of return for all investments being considered. The level of risk inherent in each investment is reflected in the required rate of return.

Net Present Value. Using the investor's required return to calculate the present value of the future benefits and subtracting the investment's cost from the present value of the future benefits gives the investment's net present value. For example, an investor with a required rate of return of 15 percent is considering an investment that costs $2,284 and promises $1,000 annual cash benefits for three years. What is the net present value?

Year	Annual Cash Benefit	15% Present Value Factor	Present Value
1	$1,000	.870	$ 870
2	1,000	.756	756
3	1,000	.658	658
		Present value of cash benefits	2,284
		Cash outlay	2,284
		Net present value	$ 0

If the net present value is zero (the present value of the future benefits is equal to their cost), the investment's return will be equal to the investor's required rate of return. A better understanding of how a net present value of zero provides the required rate of return can be had by considering the following example:

Year	Cash Flow	15% Return	Investment Recovery	Outstanding Investment
0	-$2,284			$2,284.00
1	1,000	$342.60	$657.40	1,626.60
2	1,000	243.99	756.01	870.59
3	1,000	130.59	869.41	$ 1.18

As shown, the first year's cash flow of $1,000 provides the investor with a 15 percent return on the $2,284 invested for the first year and reduces the amount of unrecovered investment by $657.40. By the end of the third year, the amount invested has been recovered—the small remainder results from rounding—and the investor has earned 15 percent each year on the amount of the unrecovered investment. Thus, the rate of return accounts for both the return on and the return of the investment.

The present value of an income stream discounted at the required rate of return is the price that must be paid for the future benefits if the required rate of return is to be earned. When the present value of the benefits exceed their cost, the net present value is positive, and the investor receives a return in excess of the required return. If the net present value is negative, the investment's return will be less than the investors required return. For any given set of cash benefits and cash outlay, an increase in the required rate of return decreases the investment's net present value. If the required return becomes too great, the net present value becomes negative.

When two or more projects are being compared, they can be ranked according to their net present value. All other things being equal, the project with the largest net present value will be selected because it will maximize the investor's wealth.

Internal Rate of Return. An investment's expected rate of return can be compared directly with the investor's required return. In the discussion of net present value, it was observed that there is a particular rate of discount that will make the net present value equal to zero. This rate is known as the *internal rate of return.* To find this rate, trial discount rates are chosen until the rate that results in a net present value of zero is found. As Figure 1 shows, a positive net present value of $37 is obtained with a discount rate of 14 percent. Because a net present value of zero is desired, a higher rate, say 16 percent, is tried. This rate yields a negative $38 net present value. Finally, a discount rate of 15 percent is used and a net present value of zero results.

Financial calculators and electronic spreadsheet programs make this calculation in a similar fashion—electronic spreadsheet programs, for instance, require a "guess" rate to begin the calculation of the internal rate of return.

As with the net present value method, the internal rate of return is used to compare alternatives. When two or more projects are being compared, the projects can be ranked according to their internal rate of return; each also is compared with the investor's required rate of return. Projects A and B have internal rates of return in excess of the investor's required rate of return and are acceptable; projects C and D have internal rates of return less than the investor's required rate of return and are not acceptable.

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If only one project can be funded, the project with the largest internal rate of return ordinarily will be selected because choosing it will maximize the investor's wealth (assuming that all alternatives are equal in risk).

To use present value analysis, one must have a clear understanding of net present value and the internal rate of return methods. Many investors calculate both the net present value and the internal rate of return for each investment. Others prefer to use only the internal rate of return because they understand the general concept of rate of return. Therefore, they rely on it to determine if an investment's return is adequate relative to the required rate of return and for ranking alternative investments.

Is the use of the internal rate of return instead of net present value in real estate investment analysis a problem? Ordinarily, this is not a problem because both usually result in the same ranking of alternative investments. However, this question arises because it is possible for an investor choosing between two mutually exclusive alternatives (choosing between financing proposals, for example) to discover that one alternative generates the largest net present value and the other generates the largest internal rate of return. Although the circumstances that result in such conflicts are not common in the analysis of income properties, exploring this question provides additional insight into these two approaches to measuring an investment's expected return.

Although investors have many goals, their ultimate investment goal is assumed to be wealth maximization. Using this as a guide, the example of an investment costing $2,284 and providing $1,000 annual cash benefits for three years will be re-examined. It was shown that this investment provides the investor with a 15 percent internal rate of return.

Year	Annual Cash Benefit	15% Present Value Factor	Present Value
1	$1,000	.870	$ 870
2	1,000	.756	756
3	1,000	.658	658
		Present value of benefits	2,284
		Cash outlay	2,284
		Net present value	$ 0
		Internal rate of return	15%

However, if $2,284 is invested in an alternative investment at a 15 percent compound rate for three years, it will become $3,474. Why would an investor not prefer this investment to one that produces three annual cash flows of $1,000? Because a basic assumption of present value analysis is that cash flows are reinvested. If each of the $1,000 cash flows is reinvested at 15 percent when it is received, the future value of these cash flows is $3,474:

Year	Accumulation from Previous Year	Cash Flow Reinvested at End of Year	Interest at 15%	Total
1	$ 0	$1,000		$1,000
2	1,000	1,000	$150	2,150
3	2,150	1,000	324	3,474

Thus, because of the reinvestment of the cash flows at 15 percent, both investments will accumulate to the same future value. If the reinvestment of the annual $1,000 cash flows is not possible or if reinvestment will take place at a rate less than 15 percent, the alternative investment providing $3,474 in three years would be preferred. Accordingly, it can be seen that when an internal rate of return is being calculated, it is assumed that the cash flows will be reinvested at the internal rate of return. But when a large internal rate of return is calculated, it may not be possible to find other investments with equally large expected returns in which to reinvest the cash flows.

On the other hand, in the calculation of the net present value, the required rate of return is the reinvestment rate. The required rate of return should reflect realizable returns in the market for a given level of risk; furthermore, it is assumed that an investor will not invest at a rate less than the required rate of return; if this happens, the required rate of return has been improperly established.

The net present value method is used to choose between alternatives when there is a ranking conflict between the net present value and the internal rate of return. Why? **With the net present value method, reinvestment of the cash flows takes place at the investor's required rate of return, but with the internal rate of return method, reinvestment of the cash flows must take place at the internal rate of return.** The internal rate of return can vary from project to project; this, in turn, results in a varying reinvestment rate assumption from project to project. However, the reinvestment rate assumption is constant from project to project when the net present value method is used. Furthermore, when the cash flows are reinvested at the required rate of return, the project with the largest net present value will maximize the investor's wealth.

Calculating the net present value also is superior to calculating the internal rate of return if the annual cash flows change from positive to negative to positive during the holding period. Under these circumstances, calculating the internal rate of return can result in multiple internal rates of return. No such possibility exists when calculating net present value.

Once the proper interpretation of the net present value method is firmly grasped, another advantage appears—it is easier to calculate than the internal rate of return. Only a present value table and a simple calculator are required whereas a financial calculator or a computer is necessary to quickly calculate the internal rate of return for a real estate investment having uneven cash flows over a long holding period.

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