

ECONOMICS: NET PRESENT VALUE



BASICS

OVERVIEW

- Net present value (NPV) is an approach used to evaluate the economic feasibility of an investment opportunity relative to an alternative opportunity.
- A fundamental concept is that the value of money is both a function of its quantity and the time dimension in which it is received or owed. A dollar today is worth more than a dollar in a year from now, because one can use the dollar received today for some productive purpose.
- The interest rate reflects the earning opportunity of a dollar today in terms of some future value. A dollar today, invested at 10% is equal to \$1.10 a year from now and \$1.21 dollars in two years.
- The discount rate is the interest rate that is used to reflect the opportunity cost of money. The weighted average cost of capital (WACC) is often used as an estimate of the discount rate, since it reflects the earning potential of a dollar re-invested in the overall operation.

NPV ANALYSIS

- The information necessary for a NPV analysis includes the sequence of cash flows associated with a new investment. One also needs to know the discount rate to be used which should reflect the alternative opportunity for the use of the funds. Often the weight average cost of capital is used since it reflects the average returns to be realized if the funds are to be used in the ongoing operation (the dairy). Typically in a dairy, a value of 8-10% is used to reflect the need for the operation to pay it's debt and to grow it's equity. Additionally, for each cash flow one needs to know the amount, directionality (cost, revenue) and the time at which it occurs. One hopes that the new investment being evaluated offers a greater return than the weighted average cost of capital, since this will reflect an investment that will grow the wealth of the dairy.
- The general NPV formula is:

$$N = -C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} \dots \dots \frac{C_t}{(1+r)^t}$$

Where:

C_0 = Initial cash flow (today, $t=0$) usually a cost

C_t = Net cash flow within a period t

r = discount rate (typically the weighted cost of capital)

t = number of years of the investment

- The NPV is calculated and interpreted as follows. If the NPV is negative, then the investment of interest is offering a rate of return less than the discount rate and thus is not an investment that is going to grow the wealth of the operation. If the NPV is equal to zero, then the evaluated investment offers a rate of return equal to the discount rate. An investment that has a positive NPV is expected to offer a rate of return higher than the discount rate and thus will bring additional wealth to the dairy. The NPV can be used to compare investments, where those with higher values represent greater opportunities.
- If the investment of interest has greater risk than the underlying operation (the dairy), the discount rate can be increased beyond the weighted average cost of capital. For example if the weighted cost of capital for a dairy is 10% and they are interested in opening another dairy in a distant location, the discount rate might be increased to 15% to reflect the greater uncertainty and risk.

Example Problem

- A producer is looking at 3 cows (A,B,C) that differ in their purchase prices (\$1,800, \$1,500, \$1,000) and expected net earnings per year (see chart below). The producers expected average weight of capital is 10%. Which cow is the best investment?

		Discount rate 10%			
		Year			
Cow	Purchase Price	1	2	3	Cull in year 3
A	(\$1,800)	\$500	\$600	\$600	\$600
B	(\$1,500)	\$400	\$500	\$550	\$500
C	(\$1,000)	\$250	\$275	\$350	\$350

- Calculation of the present value using a discount of 10% according to the general NPV formula above yields:

		Year					
Cow	PV of Cash flows	1	2	3	Cull in year 3	NPV	
A	(\$1,800)	\$ 455	\$ 496	\$ 451	\$ 451	\$52	
B	(\$1,500)	\$ 364	\$ 413	\$ 413	\$ 376	\$66	
C	(\$1,000)	\$ 227	\$ 227	\$ 263	\$ 263	(\$20)	

- The present values are summed to yield the NPV (right) for each cow. (Note that purchase price is assumed to occur today, so the purchase price is in terms of present value.)
- Cow C is not a lucrative investment since the NPV is negative. Its expected rate of return is estimated to be less than 10%, the needed rate to grow the wealth of the operation.
- Cow A and B, both have positive NPV values and thus offer rates of return greater than 10%. These investments would grow the overall wealth of the operation. Cow B is more lucrative than cow A since it has a greater expected NPV.

SUMMARY

- Net present value is an appropriate decision-making tool to evaluate the economic value of an investment opportunity. It can account for the timing of cash flows as well as the inherent risk associated with an investment opportunity.

- Net present value is an effective means of evaluating investment opportunities. It requires that one have a prior knowledge of the stream of cash flows associated with the investment and an estimate of the underlying weighted cost of capital (discount rate).
- NPV calculations are the basis of many culling models where the expected stream of cash flows associated with keeping a cow (and her eventual replacements) are compared to the NPV of an immediate replacement (and its eventual replacements). When the NPV of the cow goes below that of the replacement animal, the cow should be replaced.
- Excel has many financial functions that facilitate the calculation of the NPV.



MISCELLANEOUS

SEE ALSO

- Dairy Economics (www.fiveminutevet.com/ruminant)
- Economics: Net Present Value (www.fiveminutevet.com/ruminant)
- Economics: Partial Budgeting (www.fiveminutevet.com/ruminant)

ABBREVIATIONS

- C = annual net cash flow
- NPV = net present value
- r = discount rate
- t = year

Suggested Reading

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