

Economic Measures of Profitability



Lecture notes for PET 472

Spring 2012

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Measures that ignore time value of money

net profit

payout time

return on investment, ROI

Measures that recognize the time value of money

Internal rate of return, IRR

Net present value, NPV

Discounted return on investment, DROI

- **cashflow = Revenues – royalty-expenses – taxes + depreciation**
 - Revenues = oil production*oil price + gas production*gas price
 - Gross = refers to 100%, e.g., Working Interest (WI)
 - Net = refers to revenue less royalties, Net Revenue Interest (NRI)
 - Expenses = operating expenses
 - Taxes
 1. Severance and ad valorem – based on production (\$/bbl) or net revenue (%)
 2. Federal – applied to operating income
 - Depreciation
 - A noncash expense that recognizes a decrease in a fixed asset's value due to wear & tear
- **Net income = Revenues – royalty-expenses – taxes**
- **Profit = cashflow - investment**
- Strengths
 - Simple, unambiguous
- Weakness
 - Does not inform analyst to the size of the investment or timing of the cashflow

Economics

Simplified Example

investment =	\$268,600	completed well
	\$200,000	dry hole
EUR =	234000	BO
	234000	Mcf
Future expenditures =	\$ 10,000	year 3 pumping un
	\$ 20,000	year 5 workover
W.I. =	100%	
effective annual interest rate =	10%	
Type of discounting =	mid-year	

Year	Annual oil production BO	Annual net income* \$	Future expenditures \$	Net cash flow \$	Cumulative cashflow \$	Payout time yrs	Discount factor 10%	DCF \$
0				\$(268,600)			1.000	\$ (268,600)
1	54750	132900		132900	\$(135,700)	1.00	0.953	\$ 126,715
2	54750	132900		132900	\$ (2,800)	1.00	0.867	\$ 115,196
3	44600	107600	10000	97600	\$ 94,800	0.03	0.788	\$ 76,907
4	29200	69200		69200	\$ 164,000		0.716	\$ 49,571
5	18900	43500	20000	23500	\$ 187,500		0.651	\$ 15,304
6	12900	28600		28600	\$ 216,100		0.592	\$ 16,932
7	7800	15900		15900	\$ 232,000		0.538	\$ 8,557
8	5200	9400		9400	\$ 241,400		0.489	\$ 4,599
9	3700	5600		5600	\$ 247,000		0.445	\$ 2,491
10	2200	1900		1900	\$ 248,900		0.404	\$ 768
sum =	234000	547500	30000	\$ 248,900		2.03		\$ 148,441

* Annual net income = annual gross revenue-royalty-taxes-operating expenses

- Length of time until investment is paid in full

$$\sum_{i=1}^n \text{AFIT Cashflow } \{ \$ / \text{yr} \} = \text{Capital investment } \{ \$ \}$$

- Strengths
 - Simple, unambiguous
 - Measures an impact on liquidity
- Weakness
 - Considers cashflow to a point
 - Difficult for projects with large abandonment costs or rate acceleration projects

- A measure of the total profitability

$$\text{ROI} = \frac{\text{Cumulative AFIT Cashflow}}{\text{Investment}}$$

Profitable projects, ROI > 0

- Alternative, Benefits-to-cost ratio

$$\text{BCR} = \frac{\text{Cumulative AFIT Cashflow} + \text{Investment}}{\text{Investment}}$$

Profitable projects, BCR > 1

- Strengths
 - Simple
 - Recognizes a profit in relation to investment size
 - Can also use discounted cashflows, DROI
- Weakness
 - Continuing investments

Economics

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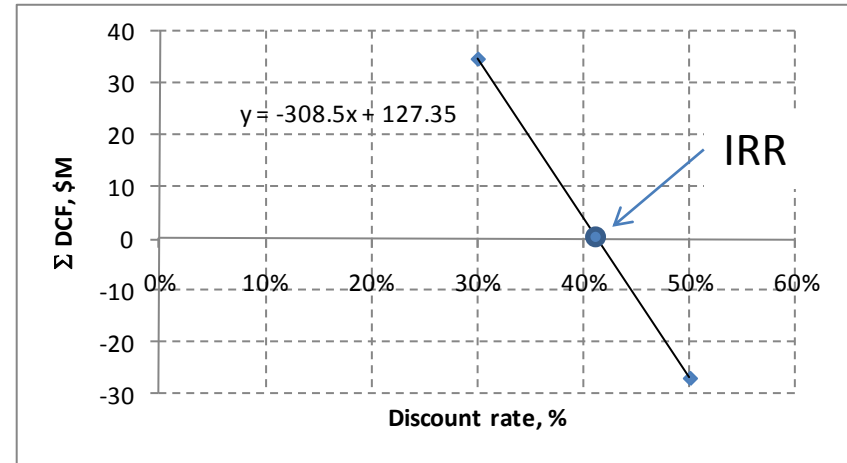
Profit =	\$248,900	
Payout time =	2.03	yrs
ROI =	0.93	
BCF =	1.93	

- A measure of the present value of future cash flows: $PV = FV(1+i)^{-t}$
 - FV – future value
 - i – effective annual discount rate
- Discount factor = $(1+i)^{-t}$
- Characteristics
 - Project NPV is sum of cashflows
 - Not trial and error
 - NPV has features of IRR regarding time value of money
 - Suitable for probabilities
 - NPV = 0...investment yields a rate of return = discount rate
 - Does not indicate size of cashflows
 - Discount rate can vary for a given project
 - PV concept works with (-) numbers
 - Specifying discount rate is difficult
- Mid-year discounting = $(1+i)^{-t+1/2}$

Economics

Rate of Return, IRR

- The discount rate such that $NPV = 0$



- Characteristics

- Includes time value of money
- trial and error
- Independent of magnitude of cashflows
- Cannot calculate IRR if cashflows all (+) or (-)
- Cashflows received early in the project are weighted more heavily
- Sensitive to initial investment
- Convenient % to compare with corporate objectives
- Reinvestment assumption-all cashflows received will be reinvested at the computed rate of return
- Competing investments have different (IRR) time values of money, thus IRR may not be a realistic parameter to assess rank
- Cannot use probability
- Can be computed BFIT and AFIT

Economics

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NPV @ $i =$

Internal rate of return (IRR)

i %	Σ DCF \$M
10%	148.4
50%	-26.9
30%	34.8

IRR =

DROI =

