



# ROI & ROE

---

John T. Condo  
Actuarial Resources Corporation

# Definition of ROI & ROE

---

**ROI**            Rate at which renewal profits must be discounted in order to equal the first year's investment.

**ROE**            Income divided by equity. Usually, we think of GAAP Income for a year divided by GAAP equity at the beginning of the year.

# Key Relationship Between ROI & ROE

The equation

$$\text{Equity}_0 = \sum_{t=1}^n \frac{\text{Cash Flow}_t}{(1+x_1)\dots(1+x_t)} + \frac{\text{Equity}_n}{(1+x_1)\dots(1+x_n)}$$

is satisfied if either

- 1)  $x_t$  is equal to the ROI for all  $t$ , or
- 2)  $x_t$  is equal to  $\text{ROE}_t$  for all  $t$ .

## Sample Product with 13% ROI, 11% Investment Earnings Rate and 9.5% DAC Amortization Rate

### Single Year's Production

Time	GAAP Equity	GAAP Income	ROE
0	\$ 1,000,000.00	\$ 0	0%
1	1,072,081.13	72,081.13	7.21%
2	1,166,689.92	94,608.78	8.82%
3	1,286,395.96	119,706.05	10.26%
4	1,434,060.25	147,664.29	11.48%
5	1,612,868.00	178,807.75	12.47%
6	1,826,365.22	213,497.22	13.24%
7	2,078,499.43	252,134.20	13.81%
8	2,373,664.84	295,165.41	14.20%
9	2,716,752.76	343,087.92	14.45%
10	3,113,207.53	396,454.77	14.59%

## Sample Product Experiencing Rapid Growth (ROI = 13%)

Production grows from \$1M to \$200M over 10 Years

Time		GAAP Equity	GAAP Income	ROE
0	\$	1,000,000.00	\$ 0	0%
1		3,072,081.13	72,081.13	7.21%
2		8,310,852.18	238,771.05	7.77%
3		18,980,181.47	669,329.28	8.05%
4		40,561,113.10	1,580,931.63	8.33%
5		84,021,490.16	3,460,377.06	8.53%
6		171,303,405.80	7,281,915.64	8.67%
7		311,298,179.04	14,994,773.23	8.75%
8		514,273,548.42	27,975,369.38	8.99%
9		762,102,116.89	47,828,568.47	9.30%
10		836,353,333.62	74,251,216.73	9.74%

## Sample Product as an Established Block of Business (ROI = 13%)

### Production Increases by 30% Every 10 Years

Time	GAAP Equity	GAAP Income	ROE
0	\$ 3,980,690,262.68	\$ 485,388,157.31	0%
1	4,081,056,574.69	502,819,138.25	12.63%
2	4,161,418,831.80	516,173,573.70	12.65%
3	4,233,341,072.31	526,639,217.34	12.66%
4	4,305,911,743.49	535,740,478.12	12.66%
5	4,381,261,963.06	544,972,856.63	12.66%
6	4,457,681,932.84	554,495,436.95	12.66%
7	4,531,152,943.24	564,225,722.74	12.66%
8	4,605,365,143.50	573,419,742.72	12.66%
9	4,682,488,884.35	582,784,113.42	12.65%
10	4,762,858,083.46	592,482,401.80	12.65%

# ROE Relief if ROE Pattern is Increasing

- Slow new business production
- Put more surplus towards acquiring new business
- Pay out earnings as dividends
- If product is UL or DA, increase credited rate
- Urge long-term view of product
- Price to ROE target as opposed to ROI
- If pricing target is ROI, set ROI hurdle higher than required ROE