



Present Value in Perpetuity (PVP)

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#19

PRESENT VALUE IN PERPETUITY (PVP)

Your doting Aunt Tillie passes to her reward, leaving you some timberland in northern California. You learn that timberland in California is assessed for property tax purposes based on its "capitalized income," regardless of market value. You wonder if the assessment on your tax bill is correct, so you do some research.

You learn you can plant trees for \$100/acre, and sell them to a logger for \$900/acre after 32 years. Using $i = .06$, what is the value of the land?

Procedure. You are tempted to find the net PV and call that the land value, but that is not quite right. Why not? Because after generation #1 there are #2, #3, etc. ad inf. So instead figure the annuity of 32 years corresponding to the PV; then divide that by i (thus capitalizing it in perpetuity).

ANSWER:

Let G_1 = PV of Generation #1.

$$G_1 = -\$100 + \$900 \cdot 1.06^{-32} = \$39.46$$

$$IPF = .0710$$

$$G_1 \cdot IPF = \$2.802$$

$$PVP = \$2.802 / .06 = \$46.70$$

COMMENSURABILITY

An advantage of the procedure above is that you can compare the wisdom of planting trees of different lives. Your result makes different lives commensurable, so, having followed this procedure for rival uses of the same land, you just have to pick the highest number.

Which yields the higher land value: \$900 in 32 years, or \$300 in 5 years? Just for practice, in this problem vary the procedure: use the Faustmann approach. This means you evaluate each cycle at the end of n years, instead of at time 0. Then annualize using the Sinking Fund Factor instead of the IPF. Also, to save a step, divide the SFF itself by i before applying it. It's not as involved as it sounds: you end up just dividing the \$ values by $[I^n - 1]$.

ANSWER:

$$\$900/[1.06^{32}-1] = \$900/5.45 = \$165$$

$$\$300/[1.06^5-1] = \$300/.338 = \$888$$

LABOR VS. CAPITAL

Hold it, though! Haven't we left something out? Yes, those restocking costs of \$100/acre. In the 5-year cycle they come along more than 6 times during the 32-year life of the longer cycle. Will that make the shorter cycle look worse? Try again:

$$[\$900-\$100 \cdot 1.06^{32}]/5.45 = \$254/5.45 = \$46.61$$

$$[\$300-\$100 \cdot 1.06^5]/.338 = \$166/.338 = \$491$$

Actually, now, the 5-year cycle has gained more advantage. It did outvalue the 32-year cycle by 888/165, or 5.38 to 1. Now, by accounting for planting costs, it outvalues the 32-year cycle by 491/46.6, or 10.54 to 1. There's an interesting contrast. How come?

In the 32-year cycle, we invested \$100 just once; in the 5 year cycle, we invest \$100 over six times in 32 years. You might think, intuitively, that overlooking this factor would favor the shorter cycle, because the total money spent on planting is so much greater, over time. It works out just the other way.

Why? Because with the slower cycle you leave that capital tied up longer, so a higher share of the product imputes to capital in the form of interest. It is true that a much larger share of the product imputes to labor, which gets paid each time trees are replanted. On balance, though, more surplus remains for land in the shorter cycle.

Examples like this one establish that if we as a nation want to raise the demand for labor, and get by with less capital, we can do so simply by shortening most investment cycles. In a free market the costs of labor and capital would adjust to make this happen. The nation is bound by a host of institutional biases that keep the market from working this out - hence the problems young people face in the job market (older people are affected by these problems, too). Regardless, though, you as a manager of a struggling new enterprise will do well to substitute labor for capital by recovering your capital as some people are said to vote, "early and often."