



Effect of Harvest Tax Applied to Stumpage Value of Timber on Present Net Worth of Timber Land

By Dr. Mason Gaffney

Article citation:

Gaffney, Mason. "Effect of Harvest Tax Applied to Stumpage Value of Timber on Present Net Worth of Timber Land." 21 May 1975. Notes.

Fair Use Disclaimer

The Robert Schalkenbach Foundation, a non profit private foundation, is publishing this article, at no cost, pursuant to the Fair Use provisions of Section 107 of the Copyright Act which states that under certain circumstances, the fair use of a copyrighted material for purposes of criticism, comment, teaching, scholarship and research is not an infringement of copyright. If you have any concerns about the publication of this article, please contact us at info@schalkenbach.org.

The Robert Schalkenbach Foundation's Digital Collections and Archives is an extension of the Robert Schalkenbach Foundation's Engel Georgist Library. It collects, organizes, preserves, and provides free online access to researchers and the general public of Georgist literature including books, newspapers, pamphlets, scholarly articles and archival materials.

RSF is particularly proud to offer free online access to the works of the late Georgist scholar Mason Gaffney, made possible through the generosity of the Danica Foundation and with the consent of the Mason and Letitia Gaffney Trust.

Robert Schalkenbach Foundation: <https://schalkenbach.org/>

Engel Georgist Library: <https://www.librarycat.org/lib/EngelGeorgistLibrary>

RSF Digital Collections and Archives: <https://schalkenbach.starter1ua.preservica.com/>

EFFECT OF HARVEST TAX APPLIED TO STUMPAGE VALUE OF TIMBER
ON PRESENT NET WORTH OF TIMBER LAND

Notes by M.G., May 21, 1975

S = Site value derived from discounted future yields less costs and interest, in absence of taxes.

R = Revenue from sale of stumpage, net of harvest cost, in year m.

m = years from regeneration to maturity and harvest.

i = interest rate.

t = tax rate (in this case applied to R).

C = Cost of regeneration in year 0.

Intermediate costs and revenues are incorporated by compounding them forward to m or discounting them back to 0.

Taxes are assumed born by site owner in lower valuations, logs being sold at a market price independent of tax. (For a tax affecting large parts of the supply, this may be modified.)

$$(C + S)e^{mi} = R + S \quad (1)$$

(1) says you invest site plus regeneration cost at time 0, and recover site plus stumpage revenue at m. Solving for S, we get:

$$S = \frac{R - Ce^{mi}}{e^{mi} - 1} \quad (2)$$

(2) is Faustmann's formula for "Soil Expectation Value", widely discussed in the literature.

Maturity is assumed to arrive when growth just covers interest on its own value plus site value:

$$\Delta R = i(R + S) \quad (3)$$

(This can be shown to maximize S)

To show effect of harvest tax, let:

σ = Site value after deducting harvest tax.

$$\sigma = \frac{R(1 - t) - Ce^{mi}}{e^{mi} - 1} \quad (4)$$

By inspection, since C is not deductible, there is a leverage effect in the tax, and it falls harder on marginal investments. Marginal land is made submarginal, and there is an "excess burden" on all land, with sterilization of marginal increments to investment. If this occurred to an existing mature stand at harvest time we would call it "high-grading", a familiar problem. The harvest tax is net of harvest costs (except for substantial administrative problems), so that is not its major problem. The major problem is "invisible high-grading", i.e. the abortion in advance of marginal effort and investment in T.S.I. and regeneration.

An aspect of this problem is an associated bias against shorter growth periods. This is both more and less than a bias against intensive use of land. It is specifically a bias against labour-intensity (the frequency of applying labor for regeneration and harvest). If we ignore the land element, it is a bias to substitute capital (growing stock) for labor. When we consider all three inputs there is a clear bias against use of labor, and a much weaker bias against use of capital, offset by the bias to use capital for labor. (The property Tax, by contrast, is biased against capital and longer growth periods.)

To show the bias, we find the percentage decline of site value caused by the tax.

$$\begin{aligned} \frac{S - \sigma}{S} &= \frac{R - R(1 - t) - Ce^{mi} + Ce^{mi}}{S(e^{mi} - 1)} = \frac{tR}{S(e^{mi} - 1)} \\ &= \frac{tCe^{mi} + tS(e^{mi} - 1)}{S(e^{mi} - 1)} = t \left[1 + \frac{C}{S(1 - e^{-mi})} \right] \end{aligned} \quad (5)$$

The presence of tax-induced bias is shown by the percentage drop in net present worth's being greater than the tax rate.

Inspection of (5) shows the directions of bias. (5) is an increasing function of $\underline{C}$, and a decreasing function of $\underline{S}$ and $\underline{m}$. ($\underline{t}$ and $\underline{i}$ are not the subjects here.)

If $C = 0$ there is no excess decline, i.e.

$$\text{When } C = 0, \frac{S - C^*}{S} - t = 0 \quad (6)$$

Thus yield taxes are easiest on management plans that depend on natural regeneration supplied by nature, "free" of labor cost but not free of cost, since there is a long required input of bare-land-time that substitutes for labor.

More generally, the bias is against planting and T.S.I. investments, and in favor of another kind of investment, that is in mature growing stock derived from accumulated site rents incorporated in timber ("geogenic capital") and compound interest ("autogenetic capital").

Table 1 is a numerical example of the bias. The numbers in Table 1 refer to the last fractions in Eqn. (5), and express the "excess drop" in net present worth caused by a harvest tax.¹ The total drop in net worth is the tax rate, t , times one plus the figure displayed.

1. Under most favorable assumptions about lack of other kinds of excess burden.

TABLE 1

Values of $\frac{C}{S(1 - e^{-im})}$ for values of C/S and m ($i = .06$)

m	1-e ^{-im}	C/S								
		0	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00
15	.58	0	.86	1.72	2.59	3.45				6.90
20	.69	0	.72	1.45	2.17	2.90				
25	.77	0	.65	1.30	1.96	2.60				
30	.83	0	.60	1.20	1.81	2.41				
40	.90	0	.56	1.11	1.67	2.22				
60	.97	0	.52	1.03	1.55	2.06				4.12

Three kinds of bias stand out, one against high C, one for high S, and one for high m. Total bias is the interplay of these factors.

- marginal land is wiped out (high C/S)
- rentable or high site land is treated better, as an average, but:
- marginal investments on good land are wiped out; high C/S is treated as badly when S is high as when S is low; and;

- on good sites, marginal investments are treated worse than on bad sites because of faster growth (lower m) characterizing higher sites. This factor has not appeared very important in the past because when m > 60 anyway, the effect is weak. However, this is changing very rapidly. Progressive management is looking to species and methods and products that cut down the enormous capital requirements of long growth periods, and current regeneration, if it is to be at all economical, must move into periods well under 50 years.

Note, too, that long cycles could only be justified at $i < .06$ (the

value used in the table is .06) and using, say, $i = .03$, would make the "excess decline" more sensitive to $\underline{m}$ at $m > 50$ than is true in Table 1, where $i = .06$.

Putting it all together, the most aggravated allocation bias shown is that against intensive investment and management on good land. Income from easy going use of good land (low C/S) is treated favorably, so the distributive shares of the owners are sheltered. It is the incremental income from better management that is hardest hit.

As to marginal land, we must evaluate the bias against it in conjunction with the heavy public costs and subsidies associated with tapping it. Much land that is marginal to private persons is submarginal to society. In my opinion, therefore, the damage of greatest social concern is the bias against full use of good land.