A Simple General Test for Tax Bias

By Mason Gaffney*

Abstract. The paper infers the biasing effects of taxes from their differential effects on the present values of rival uses for given tracts of land. After-tax wage rates, interest rates, and commodity prices are exogenous, hence not affected by taxes, which are therefore all shifted to land rents and values. The effects are differential among rival uses, hence change their ranking in the eyes of the landowner-manager. Most taxes downgrade the highest use into a lower use, inducing quantum leaps away from higher and better uses into lower and worse uses. The paper uses forestry as an allegory for all land uses. It compares yield taxes, property taxes, income taxes, and site value taxes. It finds that a change from the first three to the site value tax would induce quantum leaps from lower to higher uses of land.

The method here is to infer the biasing effects of taxes from their differential effects on present values of rival uses for land. A local tax jurisdiction is an open economy. Our simplifying premise is that arbitrage equalizes all *after*-tax rates of return on new investing, at levels determined in world capital markets. Labor is free to come and go, and product prices are set in world markets. Given those premises, all taxes are shifted to land, the only factor fixed in an otherwise open economy; tax jurisdictions are defined as fixed areas of land.

Using these premises lets us devise a simple test for tax neutrality.[1] Treat net present value derived from a land improvement as a residual, and impute this residual value to land. Find algebraically the ratio of after-tax land value to before-tax land value. If the ratio is simply $(1 - t)$ (where t is a tax rate), the tax is neutral—the highest and best use of land after tax is the same as that before tax.[2] The ratio $(1 - t)$

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is independent of any parameter the landowner controls. The tax base on marginal land must be zero, lest the land be sterilized.[3]

The simplicity of this technique allows for complexity in the applications, without losing any threads in tangles of detail. We can analyze or just inspect many parameters in the ratio to find what specific avoidance maneuvers a tax will induce and to estimate what excess burdens will result. In this paper, we analyze effects on substitution of capital for labor and for land, including effects on capital turnover and frequency of site renewal. We analyze differential effects on different grades or qualities of land. We can also show how to find revenue-neutral tax rates, when tax A is substituted for tax B. We can point toward dangerously snowballing "Laffer-curve effects" and how to minimize them by selecting more neutral kinds of taxes.

The present study uses timber culture as an example because this enables a simple analysis, along with continuous grounding in reality. Timber is a good allegory for all other forms of investment. It occupies 32 percent of the private land area of the nation and is weighty in its own right (Daugherty 1995). This short paper does not treat other kinds of capital explicitly, but does explain a simple means of modifying the analysis to do so. The writer has published the relevant mathematics elsewhere (Gaffney 1976a, esp. Appendix I).

One distinguished commentator, Gordon Tullock, has suggested orally that this is Georgist tax theory restated. He is partly right, partly wrong. The findings are consistent with Henry George's ideas about the neutrality of taxing land values. However, George had no capital theory except an error-ridden one that no one cares to remember, while the present paper deals mostly with durable capital.

I

Harvest or Yield Tax

"YIELD" TAXES ARE IMPOSED on the harvest value of timber ("stumpage"), net of harvest costs, but gross of up-front capital costs. The tax rate is flat, at rate *t*. The taxable event is timber harvest. Yield taxes are widely believed to be neutral because the growth rate of stumpage after tax is the same as it is before tax. Our analysis is more comprehensive, however, considering the whole investment cycle, and finds a heavy bias. First, we set up the model:

S = site value from discounted cash flow (DCF) absent taxes
R = revenue from "stumpage" (sale value net of harvest costs) at maturity (year "*m*")
m = maturity (years from planting to harvest)
i = relevant interest and discount rate
t = tax rate applied to the base "R" after *m* years
P = planting cost, year zero

One may incorporate intermediate costs and revenues in the model without disturbing it, either by compounding them forward to year *m* (where they are commensurable with "R"), or by discounting them to year zero (where they are commensurable with "P"). This lets us analyze cycles of timber culture in their totality, unbound by the simple case where all costs are incurred at time zero, and all revenues come at one other point in time. Better yet, this is the "simple means" wherewith one can generalize the model from timber to any other kind of capital improvement, whatever its time pattern of costs and revenues.

Site value (S) is the present value of timber less its planting cost (P). That residual value is imputed to the site. To make it hugely more general and useful, and only marginally more intricate, we assume the investment cycle to be repeated every *m* years, in perpetuity. That accounts for the "−1" in the denominator of Equation (1).

$$S = \frac{R - Pe^{mi}}{e^{mi} - 1} \tag{1}$$

Equation (1) is Faustmann's formula for "Soil Expectation Value," widely discussed in the literature. It is derived by discounting the numerator not just once, but as an infinite chain repeatable in perpetuity (Gaffney 1957; Scott 1987, and works there cited).[4] An advantage of this model is to dispense with any arbitrary limit on the time horizon; it lets us treat capital turnover and replacement.

To show the effect of a yield tax, let:

σ = Site value after Yield Tax

$$\sigma = \frac{R(1-t) - Pe^{mi}}{e^{mi} - 1}. \qquad (2)$$

By inspection, since P is not deductible, there is a leverage effect in the tax: it falls harder on marginal investments. It induces entrepreneurs to abort marginal investments on all land, and all investments on marginal land, causing an "excess burden." By assumption, this excess burden does not result from forward shifting to consumers with elastic demand, nor from backward shifting to suppliers of capital or labor. It results from "downward" shifting to land. It changes what now appears to the owner as the highest and best use of land, after tax.

To measure the bias, we find σ as a fraction of S:

$$\sigma/S = 1 - t\left[1 + \frac{P/S}{1 - e^{-im}}\right]. \qquad (3)$$

Equation (3) is smaller than $(1 - t)$, except when P = 0. Simple inspection of the algebra now lets us identify several kinds of bias. Equation (3) is highly sensitive to the parameters P, S, *i*, and *m*. Equation (3) is a decreasing function of P, and an increasing function of S, *m*, and *i*. Thus the yield tax biases landowners against intensive planting (high P) and against shorter cycles (low *m*), and against marginal land (low S). It also magnifies the advantage of those with strong financing (low *i*) over those with weak credit. The last force will act toward fostering higher concentration of ownership.

Taxes on marginal land are greater than zero. Equation (3) may easily become zero or negative, meaning land will have no use at all (without adapting the parameters to avoid taxes). If after-tax land value is zero or less, land-time has no value to the owner, and there is no economic reason to restock land. The combination would lead to a bias in favor either of nonuse or of "volunteer" regeneration, where P is held at zero. This comes at the cost of deferring *m* and lowering R, possibly to zero. Bias is a maximum against marginal land (low S) and, by clear inference, against marginal increments of P and R to all land.

Table 1

Values of σ/S from Equation (3), where $i = 0.07$; $t = 0.40$

	P/S = >	0.2	0.5	0.75	1	1.5
m	$1 - e^{-im}$	—	—	—	—	—
5	0.30	0.33	−0.07	−0.40	−0.73	−1.4
10	0.50	0.44	0.20	0.00	−0.20	−0.60
15	0.65	0.48	0.29	0.14	−0.02	−0.32
20	0.75	0.49	0.33	0.20	0.07	−0.20
50	0.97	0.52	0.39	0.29	0.19	−0.02
60	0.99	0.52	0.40	0.30	0.20	−0.01

Table 1 displays the bias by numerical example, using i = 0.07 and t = 0.40. The 40 percent yield tax rate is chosen because it is the revenue-neutral rate corresponding to a 1 percent property tax rate, as explained and calculated later.

To avoid taxes, landowners are induced to move from the upper right toward the lower left in Table 1; in other words, from high P/S and low m to low P/S and high m. The resulting loss of net present value before tax is a measure of excess burden. Just how far each landowner will move depends on a host of particulars far too numerous to treat in the small compass here. The point is that the tax introduces a powerful arbitrary bias, acting in predictable directions.

The landowner subject to yield taxes is in the same position as a share tenant. Modern work on share tenancy, following Gale Johnson and Stephen Cheung (1969), also stresses the logical counterpart: crop-sharing motivates tenants to take up land without limit. Private landlords big enough to dominate their markets use their bargaining power to prevent that by limiting the land they mete out to each tenant; but the fisc has no such power over private landowners. A byproduct of yield taxation is, therefore, a tendency toward reenforcing concentration of ownership of forest land.

Many forest outlays come well after time-zero: examples are thinning, pruning, fire and pest control, and timber stand improvement (TSI). Each such outlay is a separate investment cycle of shorter life than *m*. Its resulting revenue is the increment it generates in total R. Each such cycle would be punished by a yield tax in terms of its own short life, not the entire tree lifecycle of *m* years. The bias against such outlays is, from Table 1, obviously extra heavy.

II

Property Tax on Standing Timber

PROPERTY TAXES ARE IMPOSED ANNUALLY on a base equal to the assessed market value of standing timber, starting when timber is planted. The base is not the value of timber for immediate harvest, which may be nil for some years. It is its investment value to a buyer who will hold it until maturity. The tax rate is flat, at rate *p*. The taxable event is owning timber on the annual tax date.

S, R, m, i, and P are as before.

p = property tax rate
θ = site value after property tax on timber (not land)

θ is the value that satisfies Equation (1) when we add *p* to *i*:

$$\theta = \frac{R - Pe^{(i+p)m}}{e^{(i+p)m} - 1}. \tag{4}$$

By inspection of Equation (4), the effect of the property tax on timber is the same as the effect of raising the discount rate by the amount of the tax.

Finding θ as a fraction of S, we get what appears to be a complex expression; but we will simplify it greatly:

$$\theta/S = \frac{e^{im} - 1}{e^{(i+p)m} - 1} - (P/S)\frac{e^{pm} - 1}{e^{pm} - e^{-im}}. \tag{5}$$

Equation (5) looks fierce, but may be tamed by tabulating its two coefficients. Better yet, they are complements, reducing them to one. We name the first coefficient, Ω. Thus, Equation (5) may be rewritten:

$$\theta/S = \Omega - (1 - \Omega)P/S \tag{5A}$$

Table 2

Values of θ/S from Equation (5A), where $i = 0.07$; $p = 0.01$

	P/S = >	0.2	0.5	0.75	1	1.5
m	Ω	—	—	—	—	—
5	0.85	0.82	0.78	0.74	0.70	0.63
10	0.83	0.80	0.75	0.70	0.66	0.58
15	0.80	0.76	0.70	0.65	0.60	0.50
20	0.77	0.72	0.66	0.60	0.54	0.43
50	0.60	0.52	0.40	0.30	0.20	0.00
60	0.55	0.46	0.34	0.21	0.10	−0.13

Ω, in turn, may be tabulated, and varies within narrow limits. Needed values of Ω are given in Table 2, Column 2. Thus Equation (5), despite its complex first impression, becomes docile and tractable.

Table 2 displays values of θ/S when i = 0.07, and p = 0.01. It is comparable with Table 1 to expedite comparing the effects of property taxes and yield taxes. The 40 percent yield tax rate (t) is revenue-neutral with a 1 percent property tax rate (p), as we calculate and explain below.

Tax avoidance induces landowners to move from the lower right toward the upper left in Table 2; in other words, from high P/S and high *m* to low P/S and low *m*. Like the yield tax, the property tax induces less application of capital. However, the taxes differ in their effects on long versus short cycles. Yield taxes favor longer cycles; property taxes favor shorter ones.

Note, though, that the property tax bias is weaker than the yield tax bias, and much weaker when *m* is low. This finding refutes "conventional wisdom" about the catastrophic effects of the property tax on standing timber. The property tax is not without sin, but neither is it the most counterproductive tax. Its biases are considerably abated by a double capitalization effect. Like all taxes, it lowers site value, but it also lowers the value of standing timber itself, thus tempering the tax burden. The literature sometimes recognizes the first effect, but hardly ever the second.

A useful byproduct of that model is to determine what yield tax rate is revenue neutral when yield taxes are substituted for property taxes on timber (as they now are in most states). No one rate can be revenue neutral everywhere because this will depend on the value of *m*. For an example, let $m = 50$. This would apply on the West Coast, where rotations are much longer than in the southeast. Now we ask: "What value of *t* makes $\sigma = \theta$ when $p = 0.01$?" This is revenue neutral in the sense that the present value of taxes is the same in either case.

It does not adjust for taxpayer avoidance reactions, which limits its generality, and overstates revenue from both taxes, but especially from yield taxes. Tables 1 and 2 indicate that bias is stronger under a yield tax than under a property tax, so avoidance behavior will be correspondingly more extreme. Thus, the comparison made here is probably too favorable to a yield tax.

The calculation is greatly simplified, without significant loss of accuracy, by setting $P = 0$.[5] Now we have $\sigma = \theta$ when:

$$S(1-t) = S(\Omega)$$
$$t = 1 - \Omega = 1 - 0.60 = 0.40. \qquad (6)$$

Thus, for revenue neutrality, a yield tax rate of 40 percent is needed for each 1 percent cut in the property tax. At such a high rate, there would be a severe Laffer-curve effect: a higher rate bringing in lower revenues. This effect might be so strong that no yield tax rate, however high, could replace property tax revenues.

In most states, however, the yield tax rate is much lower. In California, the rate is capped at 2.9 percent, levied in lieu of a 1 percent property tax rate. This entails not just a change in the tax base, but a near approach to tax exemption. The low tax levy makes yield taxation popular with forest interests and accounts for the support they give it. It conceals the severe excess burden that yield taxes would impose at revenue-neutral rates.[6]

The revenue-neutral value of *t* is the simple complement of Ω. Table 2 shows that Ω is sensitive to *m*, but only moderately so. This means that even where rotations are 15 years instead of the 50 years used in Equation (6), it still takes a yield tax rate of 20 percent to be revenue neutral. That is lower than 40 percent, but still consistent with our basic finding that very high yield tax rates are required for revenue neutrality.

In addition, there are other taxes to consider. The yield tax levied in lieu of a property tax induces foresters to lower both the amount of P and its *frequency* as well. Lower and less frequent P also means lower and less frequent harvests, where most payrolls are generated—and taxed. Payroll taxes, income taxes, sales taxes, gasoline taxes, and all other activity-based taxes come along less often and in lesser amounts. If we summed all taxes generated in forests, and in ancillary activities, yield taxes higher than the 40 percent shown would be needed for revenue neutrality. Again, rates this high would cause a heavy Laffer-curve effect such that revenue neutrality might never be attained.

Thus, the tax bias shown is more than just "allocational," or microeconomic. It is also a bias against aggregate employment on the nation's fixed stock of land. Yield taxes make timber culture less labor using, more land using, and more capital using (in the Austrian sense of longer investment cycles). Timber culture, in the present analysis, is an allegory that applies to all investments of whatever kind, so its implications are general and macroeconomic. Tax biases like those analyzed here affect every parcel of land subject to taxation. The writer has developed this theme elsewhere (Gaffney 1976a, 1976b).

III

Tax on Income from Property

THE EXTREME INTERTEMPORAL BIAS of the yield tax, and some of its bias against P, are abated by letting the grower deduct P from the tax base. It makes a great difference *when* the grower may deduct it. For a tax on all property income (from both timber and site), let him or her deduct it at maturity, *m*. Let:

π = Site value after tax on property income

r = Corresponding tax rate on property income

$$\pi = \frac{R(1-r) - Pe^{im} + rP}{e^{im} - 1} \tag{7}$$

$$\pi/S = 1 - r(1 + P/S). \tag{8}$$

Equation (8) does away with explicit intertemporal bias: *m* does not appear in it. However, Equation (8) retains a bias against high values of P and low values of S.[7] For $m > 30$ years or so, the gradient of bias is only negligibly less than that shown in Table 1 for the yield tax. Comparing Equations (8) and (3) makes clear the reason why. Equation (3) approaches Equation (8) as *m* approaches infinity, and, in practice, as *m* exceeds 30 or so.

There is implicit intertemporal bias, too, because the bias against P tends to lower and/or defer the application of P. The cost of holding land is lowered during the downtime of land, the time between harvesting one rotation and planting the next. Less investment in P, when it does occur, also gets the next crop off to a slower start (e.g., if the owner seeds instead of planting nursery stock, and even more so if he or she waits for volunteer regeneration).

The absence of explicit intertemporal bias gives added force to the bias against P. The landowner has no avoidance route to soften the tax impact except to lower P. Further, the deduction of P means that the revenue-neutral tax rate is higher than for the yield tax. The higher rate, of course, leads into Laffer-curve effects, somewhat offsetting the efficiency gain that comes from letting owners deduct start-up costs.

IV

Tax on Net Site Rent or Net Site Value

THE TAX BASE MAY BE NARROWED to land, in two different ways:

a. With an income tax, by deducting P at the front end (expense it), instead of capitalizing it for later deduction;
b. Assess land directly, and levy a property tax based on site value.

A. Expensing P

Let Γ = Site value after tax on yield, when P is expensed;
u = corresponding tax rate

$$\Gamma = \frac{R(1-u) - Pe^{im} + uPe^{im}}{e^{im} - 1} = S(1-u)$$

$$\Gamma/S = 1 - u. \qquad (9)$$

Here, at last, we have a kind of tax neutrality. Equation (9) is independent of P, S, *i*, or *m*. Note, also, that we have not destroyed the tax base. The usual objection to expensing is that it is equivalent to tax exemption. So it is, for those items that are expensed. However, land purchase is not deducted nor expensed (except extra-legally, which is another story).[8] Only P is expensed, while income imputable to the site remains fully taxable. Furthermore, taxable site income is enhanced by the benefit that inures from letting foresters expense P. Under our premises, this benefit lodges in higher site rents.

The rate must be raised a great deal to maintain revenues. There is no explicit Laffer-curve effect, but a problem with this tax is moral hazard. The grower, when he or she expenses P, essentially thereby becomes the manager of capital supplied by the Treasury. The grower then owes the Treasury a high fraction of gross sales (R). The temptation to "fudge" might be too high for practical administrative control. There also is the problem of what to do when the investing firm has no outside income against which to deduct the expense of P. Marketing of excess expenses is conceivable, but the unpopularity of "safe harbor" provisions helped kill the investment tax credit (ITC) in the early 1980s.

Further, during the downtime of land after harvest, this method offers a carrot but wields no stick (has no income effect or cash-flow effect), compared with the next method.

B. A Property Tax Limited to Site Value

Let:

φ = Site value after tax on site value

w = Corresponding tax rate on φ

$T = w\varphi$

T/i = Present value of future taxes in perpetuity

$$\varphi = S - T/i = S - w\varphi/i. \tag{10}$$

Since φ is both the tax base, and the after-tax value, it appears on both sides of Equation (10). This is the classic phenomenon of land tax "capitalization."[9] One resolves the apparent "dilemma" algebraically by collecting terms. Doing so, the property tax rate is simply added to the capitalization rate, a routine procedure among professional appraisers and assessors.

$$\begin{aligned}\varphi &= \mathrm{Si}/(\mathrm{i} + \mathrm{w}) \\ \varphi/\mathrm{S} &= \mathrm{i}/(\mathrm{i} + \mathrm{w})\end{aligned} \tag{11}$$

Equation (11) is independent of P or *m* or S. It is allocationally neutral. That means that the rate may be raised to any high level without imposing an excess burden, and without any self-defeating Laffer-curve effect. Equation (11) is also an increasing function of *i*. This means the effect of the tax is to weaken the advantage of buyers with strong financing (low *i*) over those with poorer access to credit.

Note a counterintuitive feature of land tax capitalization in Equation (11). The tax rate, *w*, may rise above 100 percent without destroying the tax base, φ. A higher tax rate lowers the base, but this is not a Laffer-curve effect because the base falls in lesser proportion than the rate rises, resulting always in higher collections. You have to apply a higher rate, but you keep raising more revenue, and you do not abort any investing or producing, even on marginal land.

Popular political rhetoric about Laffer-curve effects (now also called "dynamic revenue forecasting") lumps all taxes as though they were homogeneous. Some apparently cool-headed economic analysis, regrettably, does the same. This is careless and misleading. It keeps us from analyzing the structure of different taxes. Some taxes have powerful Laffer-curve effects; some have weak effects; some have none at all.[10] To understand and remedy our revenue predicament, we need to take account of these basic differences.

There is no moral hazard problem with the site-value tax ($\mathrm{w}\varphi$), as there is with the tax on land income ($\mathrm{u}\Gamma$). The landowner is not managing any of the Treasury's capital; only his or her own. Accurate assessment of site value now becomes more critical in one sense, but in another sense not at all. Accurate assessment is highly desirable, for obvious reasons of distribution, social morale, and revenue. However, William Vickrey often pointed out that inaccurate land assessments will not bias land use, our present subject, as long as they are not functions of the use or ownership of land.

From Equation (11), site rent (Si) is now divided between the landowner and the fisc in the proportion that i bears to w. To maintain constant revenues, w must vary in proportion to the general level of market i. This is a feature of all property taxes, owing to the capitalization effect. It may appear tricky on paper, but tax collectors have coped with it over several thousand years of property tax history.

How about revenue neutrality? Suppose a state exempts standing timber from the property tax, and compensates by raising site taxes. What value of w is required to make $\varphi = \theta$ when $m = 50$ and $p = 0.01$? Simple mathematics gives us a start on answering this question, but will have to be interpreted.

$$\text{For } \varphi = \theta: \quad i/(i + w) = \Omega - (P/S)(1 - \Omega). \tag{12}$$

Solving Equation (12) for w:

$$w = i\left[\frac{1}{\Omega - (P/S)(1 - \Omega)} - 1\right]. \tag{12A}$$

Let $P/S = 0.2$, $i = 0.07$, $m = 50$, $p = 0.01$. Then $w = 0.06$. This seems like a high jump, from 0.01 to 0.06, but it overstates what is normally needed. Bear in mind that in timber culture, the ratio of site value to the value of the "improvement" (i.e., timber) is very low in the last years before harvest. The value of capital in this model begins from the value P, at time zero, but then grows exponentially for m years. It rises to the value R at the end of the growth cycle. Solving Equation (1) for R, and given the parameter values just posited, R = 194P (or 39S). Thus, in the mature years of timber, its value dwarfs the site value. In applying this model to other kinds of land improvements, the revenue-neutral value of w would be much lower than 0.06.

Likewise, where growth cycles are shorter, as with Southern Yellow Pine, values of m are much lower, resulting in higher values of Ω. These in turn give much lower values for w, because w is supersensitive to Ω. At $m = 15$, for example, $\Omega = 0.80$, and $w = 0.02$. The Appendix gives additional reasons why, in practice, the revenue-neutral rate of w is generally much lower than 0.06. The most important of these is that the site tax has no excess burden, while the tax on timber does.

Another feature of the site tax is that it picks up speculative elements of land value derived from uses other than timber culture. In many regions, these values are much higher than values derived by discounting future timber harvests alone. Taking this into account, a lower rate is revenue neutral.

The premise of Equation (11) is that assessments be based on market value. In many states, in fact, timberland owners enjoy preferential assessment of land. Under California law, for example, a state agency controls assessments, applying a legislated formula that is structured so as to ensure valuations below market (*California Revenue and Tax Code*, Section 434.5, analyzed in Gaffney 1995). The California Code also prescribes that valuations be derived from timber culture alone. Under these constraints, the revenue-neutral tax rate would have to be higher, but the "high" rate would be only nominal since it is applied to assessed values that are well below market values. The de facto rate would still be what Equation (12A) shows. An open and above-board system would, of course, use true assessments that follow the market.

V

Summary

YIELD TAXES, PROPERTY TAXES on capital, and income taxes all impose substantial excess burdens on timber culture and, by extension, on all land uses. They sterilize marginal land completely, and abort marginal increments of capital and work on all land. To abate problems of the income tax, we may allow expensing capital outlays (other than land purchase). To abate problems of the property tax, we may exempt timber and raise the rate on site value.

Notes

1. Some analysts prefer to treat rates of return after tax (RORAT) as the residual, and the criterion of neutrality. We do not enter that thicket here. For those preferring the RORAT approach, the writer has run such a test elsewhere (Gaffney 1967). The results were broadly consistent with those presented here.

2. The ratio might also be $1/(1 + t)$, or some equivalent, as in Equation (11), and be neutral.

3. A zero tax on marginal land implies a zero tax for the marginal investment on *all* land, a requisite for neutrality.

4. A simple derivation is to begin with $(P + S)e^{mi} = R + S$, and solve for S.

5. Readers may confirm this by setting the rate of 0.40, arrived at in Equation (6), in the full equation in its complex form.

6. Another factor, in *Realpolitik*, is the insurance against double taxation such as might occur if an owner were to pay property taxes for many years and then be faced with a newly enacted yield tax.

7. This is the factor omitted by Thomson and Goldstein (1971) in their defense of the neutrality of income taxation.

8. Many tax proposals now bruited, like the "flat tax" of Hall and Rabushka, would allow expensing of land purchase. Thus far, however, nothing like this has been enacted.

9. This is a puzzle or paradox for neophytes, but mathematically trivial, and routinely used in the trade by appraisers and assessors.

10. Considering income effects, wealth effects, and liquidity effects, the tax may actually raise production: a reverse Laffer-curve effect. These points are important, but beyond the scope here.

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Appendix: Taxable Capacity of the Site Value Base

For P/S > 1, Equation (12A) seriously overstates the required value of w because the excess burden of any tax other than the site tax is very great on marginal land (low S, high P/S). As a purely mathematical exercise, Equation (12A) indicates that with some parameters (low values of S and low values of Ω), no value of w, however high, would be high enough to be revenue neutral. This, however, is economically impossible within our "physiocratic" premises, where taxable surplus and land rent are synonymous. A very high rate of w will tax away all the land rent there is, which is the entire taxable surplus that could be collected by any tax.

Five reasons explain the high values of w yielded by Equation (12A). First is tax capitalization, as explained above. Second is the narrow base. Site value (S) may exceed planting costs (P) at time zero, and normally does, but by the time of harvest (m), the value of timber will have grown to many times S.

Third is that our premise in finding θ originally is to ignore taxpayer avoidance maneuvers. This results in overstating θ relative to φ by assuming that landowners continue to grow timber just as though their trees were not being taxed—even though the tax makes some land values negative (Table 2). In fact, this deadweight loss or excess burden drives some land out of use altogether, and lowers P invested on all lands. It is a maximum where S is low and Ω is low (which is when m is high). These are the very conditions that are required to make the denominator of Equation (12A) approach zero. Thus, Equation (12A) ceases to give accurate values for the required w when it appears, in terms of simple mathematics, to give sky-high values of w.

Fourth is that applying the tax p to standing timber induces owners to shorten rotations, cutting timber earlier, and thus eroding the tax base. This is another dimension of the deadweight loss or excess burden.

Fifth, a purely practical matter, is that hardly any state has ever assessed saplings at full market value in practice, as premised in the mathematics. The practice has been to overlook green timber until a few years before maturity, so the property tax on standing timber has yielded less revenue than it would if practice followed theory and law.