A BETTER WAY OF GAUGING THE EXCESS BURDEN OF SHIFTABLE TAXES

Tax-induced Misallocation and Underuse of Land

Pp. 1-4 are a one-year model; pp. 5-8 deal with durable capital

Mason Gaffney, (Rev. January 2005)

The excess burdens of shiftable taxes are gauged here by analyzing tax-induced shifting of land to lower uses. This is advanced as a truer and more general measure of excess burden, compared with the conventional exposition of "excise tax effects" and "Harberger triangles."

Why Land?

Supplies of inputs for using and improving land are highly elastic and will not hold still to be taxed. Likewise, demands for the products of land are elastic, precluding forward-shifting.[1] The supply of land, within any taxing jurisdiction, is fixed: tax jurisdictions are DEFINED as specific areas of land.

Purpose and Method

The purpose here is to show how most kinds of taxes bias landowners against uses more heavily taxed. Landowners have choices among several different uses, and different intensities of each different use. Tax-avoidance takes the form of shifting land to lower uses.

The use yielding the highest site rent and/or site value is "the highest and best use" (as judged by the market).[2] Any tax on using or improving land changes the ranking of different uses, so the highest use before-tax becomes a lower use after-tax.

Key Assumptions

Supply of land is fixed (inelastic) inside the taxing jurisdiction.
Supply of capital is elastic - it flows across boundaries.
Supplies of labor, materials, utilities, etc. are also elastic.
Demands for products and services are elastic.

A SIMPLE ONE-YEAR MODEL

To introduce this point most simply, we begin with a one-year model, where all costs are in the form of labor expenses, and there is no capital other than some working capital and supplies, too little to affect our findings. This avoids the complications of compound interest and discounting, and turnover of working capital, which we introduce later after making the basic point.

1 For simplicity, we do not here consider the monopoly position of some landowners. The writer has dealt with this elsewhere (Gaffney, 1994). It turns out to strengthen the case made here.

2 Judging the principle of consumer sovereignty itself, in the manner of Veblen for example, is beyond the scope of this demonstration.

Notation

G = Gross revenues
C = Costs (all in the form of current expenses)
N = Net revenues (same as land rent)
[N = G-C]
t = tax rate applied to C (e.g. a payroll tax)
NAT = Net revenues after tax

Note that under our assumptions, all taxes on Costs are shifted to the landowner, i.e. they come out of NAT.

$$NAT = G - C - tC = N - tC \qquad (1,A)$$

Likewise, taxes on Gross revenues come out of NAT.

$$NAT = G - C - tG = N - tG \qquad (1,B)$$

Method

The technique of this model is to find NAT/N. For a neutral tax, i.e. one with no tilting effect, this ratio (NAT/N) would be simply (1-t), meaning the tax would take a fixed fraction of the net revenue, N. Such a tax would not change the ranking of different uses in the eyes of the private owner of land. Such a tax would be one based on N, so NAT = N(1-t). (Then, of course, NAT/N = (1-t).) There are a few such taxes,[3] but they are the exception, even though the logic here tells us they should be the rule. Taxes based on values other than N, whatever rationale may be used, impose excess burdens or collateral damage.[4]

To illustrate excess burden, therefore, Equation (1,A) shows a tax based on C (Costs). This does tilt the results, as shown in Equation (2).

$$NAT/N = 1 - t[C/N] \qquad (2)$$

By inspection, (2) shows how this tax tilts the incentive structure. This tax creates a strong bias against uses with high ratios of C/N. As $C \to G$, $N \to 0$, and $C/N \to \infty$.

A high RATIO of C/N need not imply a small DIFFERENCE of C and G. If both C and G are high, their absolute difference may be large, even as their RATIO approaches unity (i.e., $C/G \to 1$). These are high-volume operations. These are either cropped at the margins, or completely driven away in response to a tax based on either C or G, rather than on N.

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3 The most obvious such tax is the part of the property tax based on land value. Another such tax could be the corporate income tax, to the extent that capital income is removed from the base by rapid depreciation. Ditto for the part of the personal income tax that falls on land rents. In practice, both of the last two have been so gutted with loopholes as to be practically negligible.

4 Early enthusiasts of the personal income tax thought they saw an analogous virtue in it. This claim has become something of a bitter joke now, with growing complexity and unfairness in the actual tax. Even in simplest terms the analogy fails, for several reasons. One is that labor supply within any taxing jurisdiction is elastic; another is that the costs of creating and improving and maintaining human beings, and of sacrificing leisure and independence, and simply reporting for work, are not deductible. Many of them are, rather, taxed additionally by calling them "consumption."

C/N may easily reach a value of 10 or more, in a labor-intensive operation. If the payroll tax (combined employer and employee shares) is 14.2%, and C/N = 10, and the taxes are all shifted to NAT (as per our assumptions), the tax takes 142% of the net return to land, and the operation cannot return anything to the landowner - no matter how productive it may be before tax.

These disfavored uses are the more intensive uses, i.e. the ones that provide more jobs and produce more goods from a given base of natural land. This tax forces downsizing of labor forces, and upsizing of land requirements per worker and per consumer. Also disfavored are uses on marginal land, where $C \rightarrow G$ even at very low intensities per acre.

On the other extreme, as $C \rightarrow 0$, the tax approaches zero too, and does not lower NAT much at all. A parking lot is an example; so is land used for grazing and breeding cattle, or sheep.

Taxes based on G alone also bias land managers against intensive uses of land. Here,

$$NAT/N = (N - tG)/N = 1 - t[G/N] \qquad (3)$$

Readers may, and I hope will, repeat the modeling used after (2), above, to show the bias from taxes based on G. It differs in detail from the bias shown in (2), but evinces the same bias against intensive uses of land. As we proceed from here, however, we will limit the modeling to taxes based on C, or parts of C, counting on readers to tailor the models, if they wish, to represent different kinds of taxes.

NUMERICAL EXAMPLE OF TAXES THAT DISTORT RENT AND LAND USE

Basic equation:

$NAT/N = 1 - t \times TRM$

TRM (Tax Rate Multiplier) = C/N = C/(G-C) = 1/[(G/C)-1]

(1)	(2)	(3)	(4)	(5)
Intensity Ratio	Difference	Reciprocal	Denominator	TRM
C/G	G-C	G/C	(3) – 1	1/(4)
0.0	G	∞	∞	0.0
0.1	.9G	10	9	.11
0.5	.5G	2	1	1.0
0.8	.2G	1.25	.25	4.0
.95	.05G	1.053	.053	18.9
1.0	0.0	1.0	0.0	∞

Notes:

1. The range of intensities is very great, both on the table and in practice. Think of some examples.

2. The **ratio** of C/G (Col. 1) is independent of their absolute levels. The **difference** of C and G (Col. 2) does depend on their absolute levels. The ratio and the difference vary independently of each other. Keep them distinct in your mind.

3. Col. (3), G/C, is the reciprocal of (1). It is there to plug into the final equation, and to help you keep things straight.

Many people carelessly and/or deceptively refer to G/C as "productivity," making it seem like a good thing, a desirable goal or "performance standard." Here we see it may simply represent the underuse of good land.

4. (4) is the denominator of TRM. Like (3), it is there to plug into the final equation, and to help you keep things straight.

It also represents the mathematical phenomenon called "leverage." Notice that as you read down columns (3) and (4), (4) drops much faster than (3). This is what happens when you subtract a constant (in this case, "1") from a variable (in this case, G/C).

It means that (4) is much more sensitive (or "elastic") than (3) to changes in G/C. The TRM varies inversely with (4), so this makes the TRM equally sensitive to (4).

5. You who like math and calculus, find the derivative and the log derivative of NAT w.r.t. C (holding G constant). The log derivative is the fractional change (i.e. the % change/100).

That may seem pretty fancy, but elasticity (€) is the ratio of two log derivatives. The denominator is the log derivative of the independent variable, in this case C, and said log derivative is simply 1/C. Bottom line: take the derivative of the function; divide this by the function, to get the log derivative; and multiply by C (the independent variable) to get elasticity.

6. A TRM as high as 18.9 means that each 1% of tax levied on C lowers land rent by 18.9%. It doesn't take much of that to induce landowners to seek lower uses, using less of the taxed inputs. First they will crop their usage of C; then they will take quantum leaps into different land uses altogether, to cut their usage of C.

What about the alleged fixity of land? The quantity of land, and all the specific lands are fixed inside any taxing jurisdiction; but the use of land, and the intensity of use, are highly variable. These are changes in capital and labor applied to the land; not in the land itself. Keep these ideas distinct.

A TAX ON DURABLE CAPITAL

The property tax

The model in (1)-(3) above is based on simple annual cycles, i.e. it contains no durable capital. We next introduce durable capital in the form of buildings, subject to the property tax. We find the same basic tilting as above, but in a larger framework of more general applicability.

Be warned, though, that this entails some understanding and use of the basic mathematics of finance. Most readers probably are conversant with such math. Those who are not will find it a barrier. They may either be content with the simple logic of Equations (1)-(3); or take the occasion to learn something about compound interest, and discounting.

We treat here of an American-style property tax, levied annually at a rate "t" on the base of the assessed value of the building on a site. We assume this building to have an assessed value of "K", the capital cost of the building when new.

(The tax considered here is only PART of the usual property tax: the part that is based on the building value, K. The American-style tax also includes the site value, which we do not treat here, because we have already shown that it is neutral. The present model treats the tax on the building, K, in isolation.)

<u>Notation and Definitions:</u>

a = annual cash flow from land and building

Cash flow = gross revenues less operating expenses (but not net of Capital cost of building, or of interest or of depreciation)

DCF = Discounted cash flow from land and building. You find this by multiplying <u>a</u> by the DCFF (DCF Factor - see below).

DCFF = Discounted cash flow factor, a standard expression in finance for converting a stream of future payments into the equivalent present value, allowing for the time value of money[5]. DCFF is also known as the Present Value Factor.

Θ (theta) = shorthand for DCFF, used in equations

K = capital cost of building, at time zero.

S = site value of land, net of costs of improving and operating land, but before taxes on building.

$$S = DCF - K \qquad (4)$$

t = property tax rate applied annually to value of building, K. [In practice today, this generally runs around 1-2% in most American jurisdictions, ranging widely from 4-5% in a few states like New Hampshire and New Jersey to .2% or so in Alabama and New Mexico.]

For simplicity I assume here that the K used as the tax base remains fixed over building life. In practice this tax base falls toward the end of life, but this simplification is tolerably accurate here, for the present purpose, because of the time value of money: the value found by applying the DCFF (Θ) to a 50-year stream of building taxes is little affected by what happens after the first 25 years or so of building life. [Later in the course we will contrast the effect of taxes on the choice between old buildings and new ones, and then this simplification will not do at all.]

5 Algebraically the DCFF = $[1-(1+i)^{-n}]/i$

SAT = Site value after deducting taxes on building. Note that the high elasticity of supply of capital means that all taxes levied on buildings are shifted to the landowners in the form of lower land values. Capital runs away from taxes; land cannot. This is why we have set up the model as we have, to focus on the sensitivity of SAT to building taxes.

$$SAT = DCF - K - \Theta tK = S - \Theta tK \quad (5)$$

R = Resale value of land after life of new building (valued at K, above). [I list this for completeness, but at this stage we will omit it, for simplicity, by assuming its discounted value to be zero, or so near zero we can overlook it. Note, however, that this simplifying assumption is not generally true, and R must be treated, and will be - later, when we study taxation of "capital gains."]

n = economic life of building of initial cost K. The tables below assume that n = 50 years.

i = interest rate used for discounting. The tables below assume that i = .07.

With n=50, and i=.07, DCFF Θ = 14

Technique of Analysis

The technique of analysis is to calculate ratios of SAT/S for various ratios of K/S. If these values were all the same, e.g. 50%, then a tax would have no effect on the ranking of land use choices. It would thus be what is called "neutral," i.e. the landowner's choices after-tax would be the same as his or her choices before tax, and we could raise the rate as high as we please without any tilting or suppressing of incentives. We show below, however, that the tax on buildings is much harder on land uses with higher ratios of K/S. This tilts the choices in favor of those uses more lightly taxed, i.e. those with lower ratios of K/S.

$$SAT/S = [S-\Theta tK]/S = 1 - \Theta t[K/S] \quad (6)$$

Table 1, below, shows how SAT/S varies with different ratios of K/S. The assumed tax rate is 2%, and the DCFF (Θ) is 14, derived from n=50 and i=.07, as shown above.

Table 1: Effect of building tax on site values

K/S	14t(K/S)	SAT/S	EXAMPLE
(1)	(2)	(3)	(4)
0.0	0.00	1	Parking lot, unpaved
0.5	.14	.86	Gasoline station
1.0	.28	.72	Auto repair shop
2.0	.56	.44	Tract house
4.0	1.12	-.12	Garden apartment
5.0	1.40	-.40	Elevator apartment

Columns (2) and (3) above are complements, so column (2) shows the fractional drop in site value caused by the 2% tax on K. (For the percentage drops, multiply each figure by 100.) Thus, when K/S is 2.0, SAT is 56% less than S.

The point of Table 1 is that the tax on buildings wipes out the entire gain from intensive uses like apartments, while not affecting low-intensity uses like parking lots at all. This is tax-induced bias, or tilting: the opposite of tax neutrality.

Sensitivity

Table 2, below, shows the effect of t, at various levels, on SAT.

Table 2: Effects of t on SAT

[Parameters: S=100, K=100, Θ=14]

t →	0	.01	.02	.04	.08
ΘtK	0	14	28	56	112
SAT	100	86	72	44	-12
-ΔSAT	-	14	14	28	56
-ΔSAT/SAT	-	.14	.16	.39	1.27

This sensitivity grows fast, as t rises. Doubling t from .01 to .02 lowers SAT by only 14%. Doubling t from .04 to .08 lowers SAT by 127%.

How about the sensitivity of SAT to K/S? Table 1, above, already deals with that. Doubling K/S from 2 to 4 lowers SAT by more than 100%.

How about the sensitivity to Θ? From (5), SAT/S is a decreasing function of Θ (SAT/S falls as Θ rises). Θ in turn is a decreasing function of the interest rate, i (Θ falls as i rises). So SAT/S is an increasing function of the interest rate. This is interesting, but we do not pursue it further at this point, leaving it for future analysis.

Note that a tax based on DCF, or any element of DCF, without deduction of K, will produce similar tilting and suppression of incentives to put land to the highest use. The only way to raise taxes without such tilting is to base them on the excess of DCF over K, that is, on S. [In practice, a tax based on S is even more free of tilting than the above suggests, because it is based on the highest use, not the existing use. That is, parking lots are taxed based on the site value, S, that might be derived from higher uses, rather than on their value merely as parking lots. We need not pursue this point here, but it does reinforce the present point (cf. n.1, above).]

S is derived from the net income imputable to the site, often called "economic rent."

[Do not confuse this site income proper with the net income of any person. Thus a tax on wage income will be shifted, in whole or in part, to employers, and through them to landowners, by lowering DCF. It will discourage labor-intensive uses. A tax on property income includes a tax on the income imputable to K. A tax on the landowner's personal income is reduced by the landowner's debt payments, is augmented by the landowner's work as a manager or laborer, and by capital that the landowner furnishes. It is not, therefore, at all the same as a tax on site value or site income.]

A sales tax, under our assumptions, is not borne by the buyer, but is shifted back to the landowner. It is based on gross sales, without even deducting expenses - i.e. it is greater than cash flow, which in turn is greater than land income. It is death on downstream operations of high turnover.

The reason for picking site value as the indicator of bias is that the supply of land is inelastic, so the effects of all taxes are reflected in land rents and prices. The S-values derived from competing uses simply decide to what use the landowner will put the land: the highest use.

Findings, summarized

1. Taxes based on K tilt landowner incentives against uses with higher ratios of K/S.

2. Taxes based on DCF, or some part of DCF, tilt landowner incentives against land uses with higher ratios of DCF/S.

3. Taxes based on S have no such bias; they are "neutral."

4. Taxes based on personal income are not the same as taxes on S, and so are not neutral. Taxes on S are based on the net income "imputable" to the site, which is not the same as the net income of the owner.

5. Taxes based on sales tilt landowners against downstream uses, and uses of high turnover.

6. Taxes based on payrolls tilt landowners against labor-intensive land uses.