Mary M. Cleveland Pho (212)873-2982 10/19/94 DRAFT 1
14 W 68th, NYC 10023 Fax (212)873-6125

TAXES, LAND VALUES, WAGES, AND THE ECONOMIC MARGIN

Effects on Banking of a Shift to Land Taxes

How might a shift to land taxation affect banks? Possible answers depend both on the size and character of the banks, and the effects of the current tax system compared to the effects of land taxes.

All banks are not alike.

Big banks lend large sums to large corporate customers. They rely heavily on the value of collateral for security. Much of that collateral is land value, especially *central* land value, that is, prime urban land, prime agricultural land, good ore deposits or productive oil fields, TV franchises for large urban markets and so forth. Big banks charge low rates for secure loans.

Small banks lend moderate sums to successful small businesses and property-owning individuals such as homeowners. The rely on a combination of collateral and the earning power of their customers, which they try to check carefully. The collateral tends to be more peripheral land, such as suburban lots, less prime farmland (e.g. on floodplains), less valuable franchises and so forth. Little banks charge high rates for less secure loans.

Loan sharks lend very small sums to struggling small businesses and property-less individuals. They rely entirely on an intimate knowledge of their customers, and possibly on coercive collection procedures. Loan sharks charge usurious rates for very risky loans.

The distribution of big banks, small banks and loan sharks reflects the distribution of wealth in a society. In less-developed countries there may be only big banks belonging and lending to the ruling elite, and village money-lenders lending to the poor majority.

The first thing a land tax does is redistribute wealth and income. It cuts into concentrated wealth both by striking directly at high land values, and by raising wages, lowering land values indirectly. It makes it harder for large corporations and wealthy individuals to hang onto valuable property without using it intensively. It makes it easier for poorer individuals to buy property. So, in the long run, a land tax favors small banks over big banks and loan sharks, because it increases the pool of customers with some property and good wages.

However, a land tax has another effect: it removes obstacles to economic activity in prime locations. But by facilitating more intensive activity in the center, it may reduce activity in marginal areas. The size of this shift to the center depends on the extent to

which the prior system pushed economic activity outward. Thus the one-shot effect of a shift to land value taxes may be to *increase central land values and devastate marginal land values*--handing a windfall to customers of big banks, while flattening customers of small banks.

I. Joeland With No Transaction Costs

In order to explore the relationship between taxes, land values, wages and the economic margin, I have developed some simple one-period computerized general equilibrium simulations.

I start with a "consumer-laborer," -- let's call him Joe. Joe only eats, works and rests. He has a "labor supply function:" If you raise his wage, he will work more. But since there is only so much time in a day, the amount he will work rises more and more slowly toward an absolute limit as wage increases. If you lower his wage, he will work less. Also if you increase his income *without changing his wage*, he will work less. This is an "income effect." For the idle rich, income effect completely outweighs any wage effect: they don't work at all.

I use the following simple labor supply function for Joe:

$$L = \frac{(D-L)w - P}{P_0 + (D-L)w - P}; \quad 0 \le L < D$$

L is labor supplied and P is exogenous profit. P_0 "base profit" and D "day" are constants. L behaves nicely, rising asymptotically towards the limit, D, as wage increases or profit falls. It never "bends backwards," which means that an increase in wage alone never has a strong enough income effect to outweigh the wage effect. P_0 affects curvature; the smaller P_0, the faster L rises and then flattens.

Next I give Joe a plot of land to grow food on. The land has a "production function." It produces food according to a formula that depends on how much labor is applied to it, the more labor, the more output, subject to diminishing returns. This is the production function:

$$F = f(T,L) = F_0 L \cdot \frac{1}{1 + a\frac{L}{T}}$$

T is land size, F is output. F_0 is a constant that depends on land quality. a is another constant that determines the rate of diminishing returns; the larger a, the higher the rate.

Joe maximizes profit, hiring himself at a wage that he sets equal to the marginal product of labor on his land:

$$\text{Max: } P = F - wL$$

$$\frac{dP}{dL} = 0 = \frac{\partial F}{\partial L} - w$$

We now have two simultaneous non-linear equations for labor supply and wage, as a function of land quality (plus other constants that won't change.) Computers are good at solving this sort of thing. After the computer dust settles, we get the rent of Joe's land, to Joe, which is just the difference between Joe's output and his wages, and in this case, equals his profit. Since this is a one-period model, rent equals land value.

Now the plot thickens. Suppose there are not one, but *six* Joes in a row. (Six, because that's the most my computer can handle.) Six Joes make up Joeland, a real general equilibrium model, a complete mini-economy. Joe One has the best land. Joe Two has the second best land, ... all the way down to Joe Six, who has the worst land. It may be profitable for Joes One, Two and Three to hire labor from Joes Four, Five and Six. The market wage in Joeland must be at just the level that the amount of labor Joes One, Two and Three want to hire equals the amount that Joes Four Five and Six want to sell.

Assuming no transactions costs, the same market wage must prevail throughout the Joeland economy. And that wage has to be the marginal product of labor on the lowest quality land in use.

Figure 1 shows applied and supplied labor in Joeland. The most labor is applied to the best land, belonging to Joe One. Joe Six's land is submarginal; only a little labor is applied to Joe Five's land. However Joe One, the richest, barely works at all; Joes Five and Six work close to the physical limit.

Figure 2 shows the income of Joes One through Six. Almost half Joe One's income is rent; a tiny bit is wages, and the rest is "leisure income"--his leisure time valued at the wage.[1] Joes Five and Six by comparison, receive little (Five) or no (Six) rent; most of their income is wages, with just a little leisure.

Now what happens if we impose an output tax on Joeland?--50% is a convenient rate. Assume the tax is simply removed from Joeland.

Figure 1

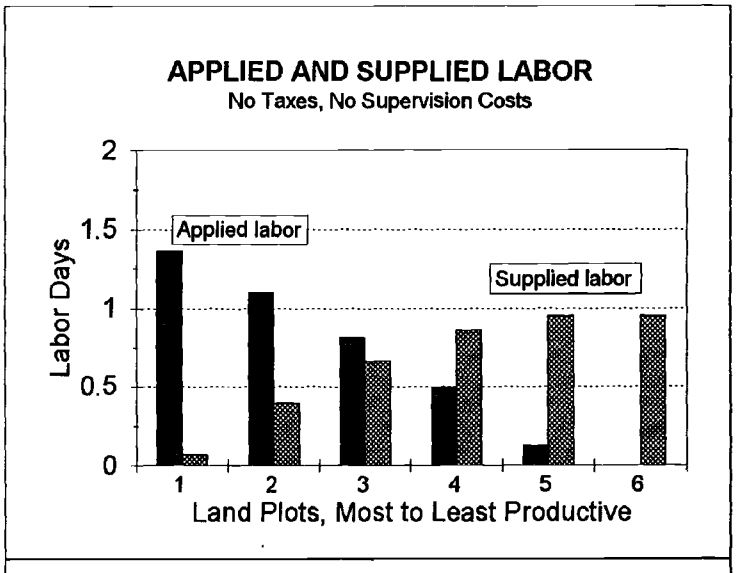


Figure 2

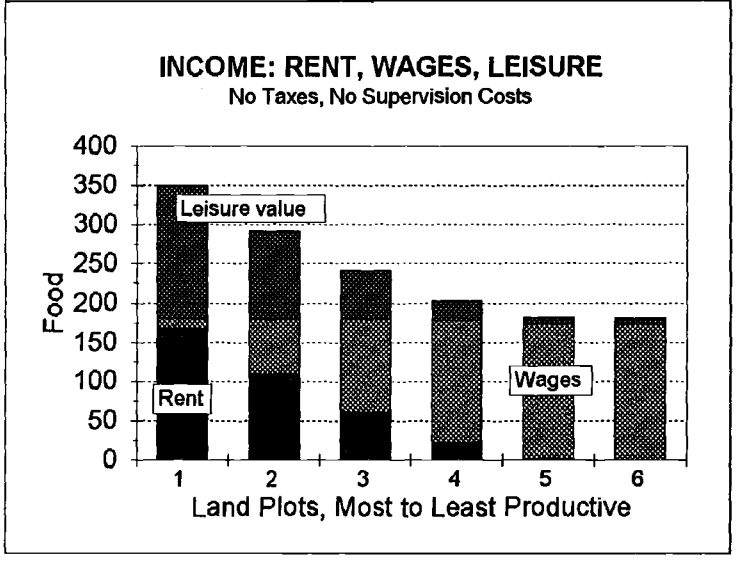


Figure 3 shows applied and supplied labor in Joeland with a 50% output tax. The pattern of applied and supplied labor is close to that with no tax. Figure 4 shows that the pattern of income does not change much either; everything is approximately cut in half, including the wage rate.

Figure 3

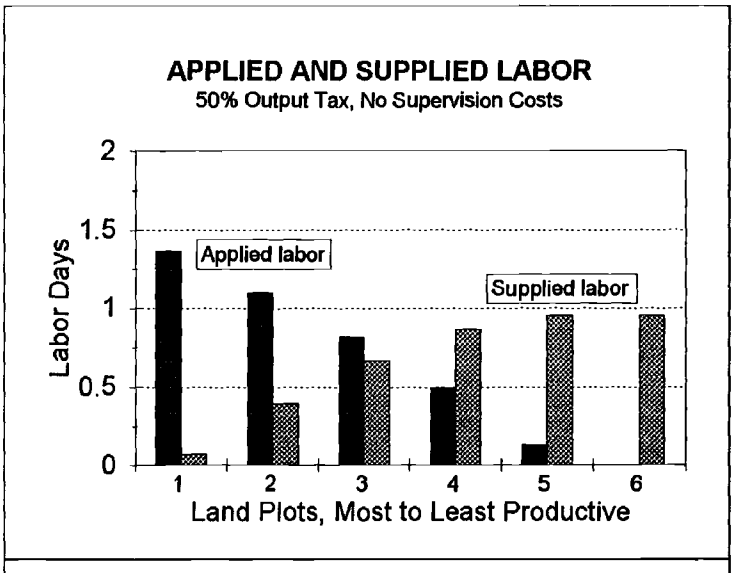
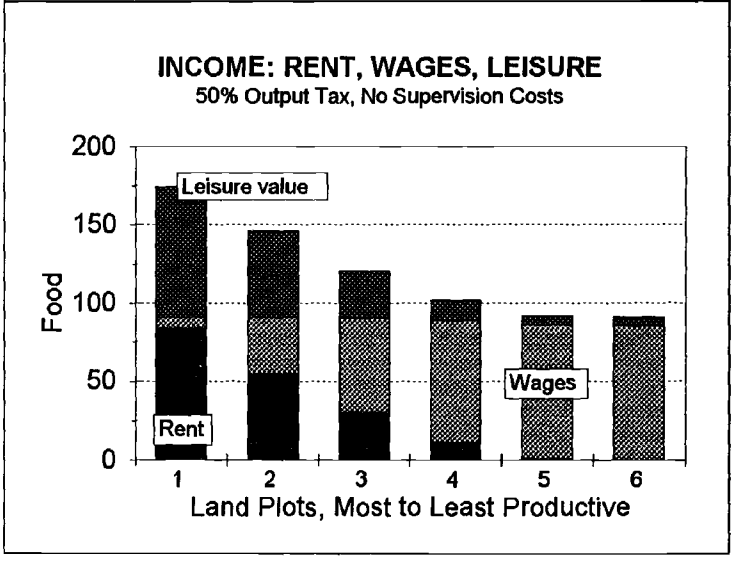


Figure 4



But what happens if we impose a land tax on Joeland, at a rate that collects the same amount of tax as a 50% tax on output. What a transformation! First of all, it takes an astounding 98% tax on before-tax land value, which equals an even more astounding 4900% tax on after-tax land value, to collect the same amount as a 50% tax on output! And the Joeland economy looks very different. Figure 5 shows applied and supplied labor. Supplied labor is much higher: *all* the Joes work close to the maximum possible time. On the marginal plot belonging to Joe Five, almost four times as much labor is applied as was with no tax or the 50% output tax. Figure 6 shows income in Joeland: all the Joes receive close to the same income, which is mostly wage income.

Figure 5

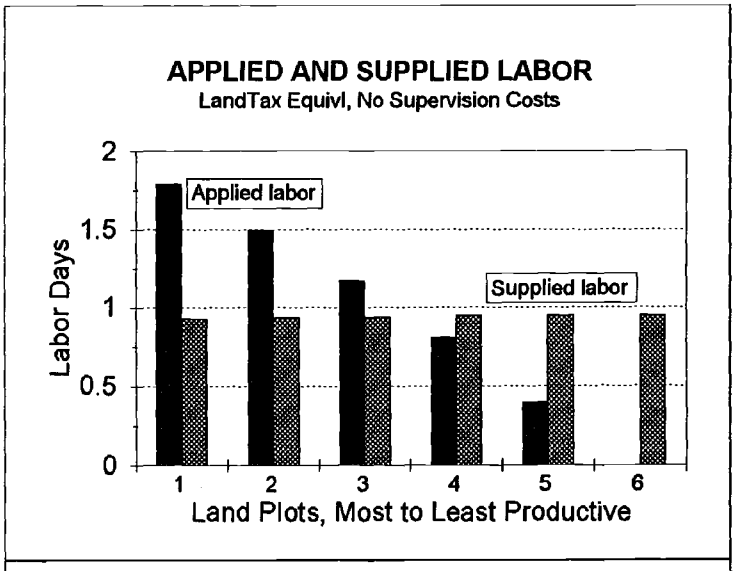


Figure 6

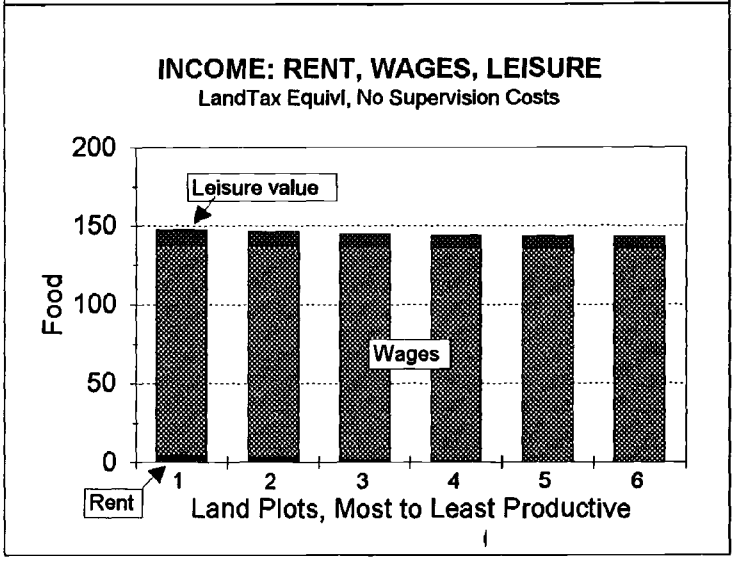


Table 1 compares selected statistics for Joeland as a whole in the three cases of no taxes, 50% output tax, and 4900% tax on land value.

For the two taxes, while the amount of tax is identical, the economic consequences are dramatically different. Output, labor supply and wage are about 50% higher for the land tax than for the output tax. The Gini Coefficient for income for the land tax is much lower than for the output tax, reflecting the strongly equalizing character of the land tax.

The comparison between no tax and the land tax also clearly illustrates that *the land tax is anything but the neutral tax of conventional theory*. The land tax does have powerful marginal effects, not directly, but indirectly. It works through an income effect: by draining rent from the wealthy, it stimulates them to work harder. Labor supply rises; the increased labor applied to marginal land lowers the wage, in this case to something midway between the no tax wage and the 50% output tax wage.

Table 1
Comparative Impact of Identical Output and Land Tax
No Supervision Costs

TAX	No Tax	50% Output Tax	4900% Land Tax
Total Labor	3.9 Man-Days	3.87 Man-Days	5.65 Man-Days
Hired Labor	2.15 Man-Days	2.11 Man-Days	1.64 Man-Days
Total Output	1067	1062	1349
Tax Amount	0	531	531
After-Tax Output	1067	531	818
After-Tax Income	1448	725	868
Wage Rate	181	91	143
Wage Income	706	352	807
Leisure Income	381	194	50
Rent Incm/Land Val	361	179	11
Gini Coef Income	.139	.137	.0063
Gini Coef Rent	.555	.556	.502

II. Joeland With Transaction Costs

The Joeland model developed so far is lacking in two ways: there is no land withholding by rich landowners, and the output tax is implausibly efficient.

First, where are the land speculators? Joe One may goof off, absent a land tax, but he does not withhold good land from use. He hires the appropriate quantity of labor at the market wage. The faulty assumption is that Joe can hire all the labor he wants at no additional cost, especially no cost of his own precious time supervising employees. In the real world, employees must be supervised, and even then they inevitably work less effectively for someone else than they do for themselves. In the real world, land withholding arises because the hidden cost of supervision deters wealthy landowners from managing land intensively (and also because they tend to prefer open green spaces.)

So, now assume that when a Joe hires labor, its effectiveness is reduced in proportion to the ratio of hired labor to own labor. I use a simple formula for the effectiveness of hired labor:

$$e\left(\frac{H}{L}\right) = \frac{1}{E_1 + E_2 \frac{H}{L}} \quad E_1 \geq 1, \quad E_2 \geq 0$$

L is Joe's own labor, H is labor hired in, and E_1 and E_2 are constants; when $E_1 = 1$ and $E_2 = 0$, there is no reduction in effectiveness of hired labor. The labor, A, applied to Joe's land becomes:

$$A = L + H\,\mathrm{e}\left(\frac{H}{L}\right) = L + \frac{H}{E_1 + E_2 \frac{H}{L}}$$

Joe now maximizes profit:

Max: $P = f(T, L + H\,\mathrm{e}) - wL - vH$

v is the market wage. w is Joe's own wage. Now the marginal product of labor exceeds the market wage, and Joe's own wage exceeds the marginal product of labor. Joe consequently hires less labor than he would if his own wage and the marginal product of labor equaled the market wage. He produces less output. And his profit falls below the rent of land, imputed at the market wage. The hidden cost of supervision has turned Joe into a land withholder.

Figure 7 shows the wage rates and marginal product of labor given supervision costs but no taxes. Supervision costs give Joe One a wage more than double the market wage, in turn raising the marginal product of labor on his land, and therefore reducing hiring and output. The reduced hiring in turn drives the market wage low enough to push the margin out onto Joe Six's land. Figure 8 shows the same with a 50% output tax; everything is cut approximately in half. Figure 9 shows the dramatic difference made by a land tax of the same amount (a 71% rate): Joe One's wage is well under twice the market wage, which is almost as high as it was with no taxes.

Figure 10 shows applied and supplied labor with supervision costs but no taxes. Joe One puts in over a half day's work; he has to, otherwise his employees would slack off too much. But the cost of supervising reduces both the quantity and effectiveness of hired labor, so Joe One's ratio of applied labor to land is lower than it was absent supervision costs, or than it should be, given the market wage. Joe One, and to a lesser extent Joes Two, Three, and Four, appear to be "withholding" land from use. Consequently, Joe Six is forced to cultivate his own land, which was submarginal with no supervision costs. Figure 11 shows the same pattern for the 50% output tax. Figure 12 shows the impact of a land tax: everyone works harder, and the ratio of land to labor is much higher on the central plots. The land tax, by taking rent from the richer Joes, makes them both work harder and hire more labor, substantially counteracting the withholding due to supervision costs.

Figure 7

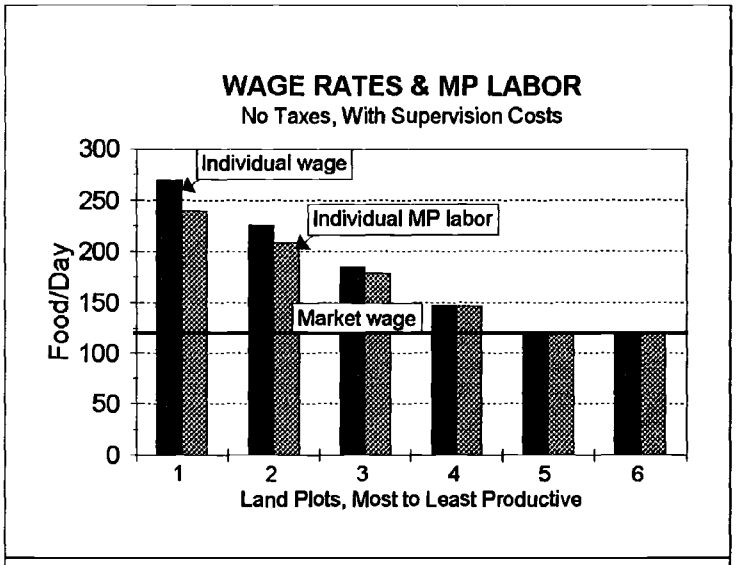


Figure 8

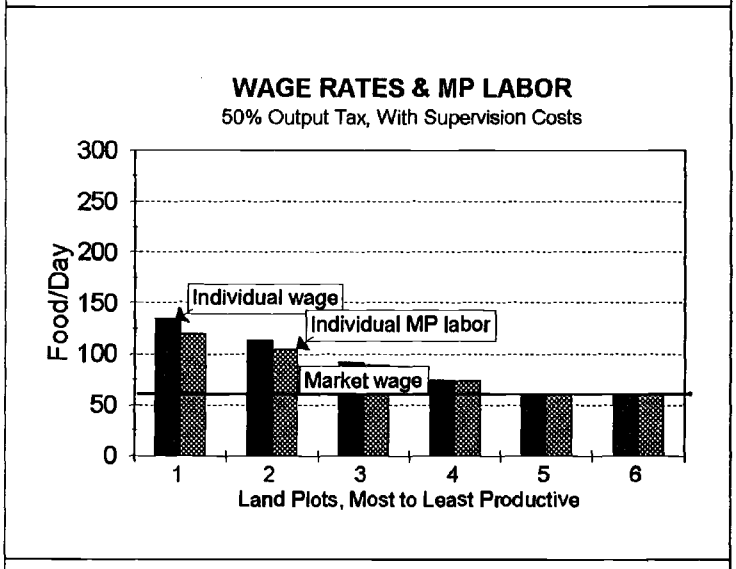


Figure 9

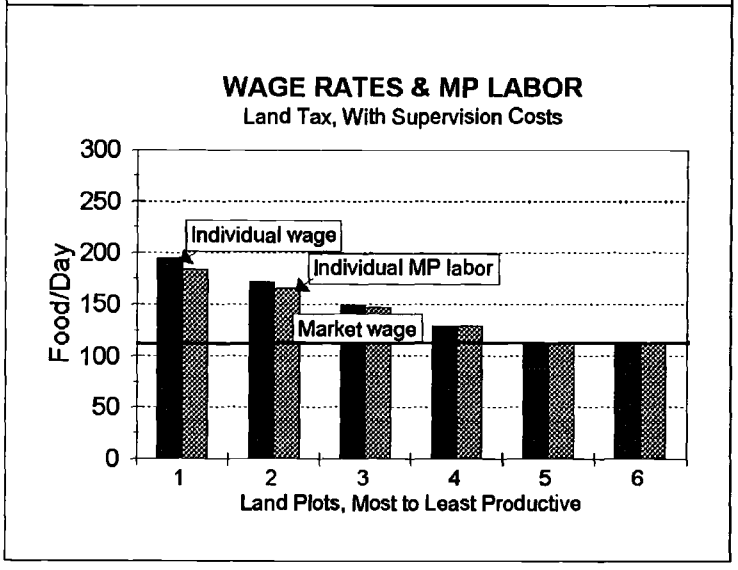


Figure 10

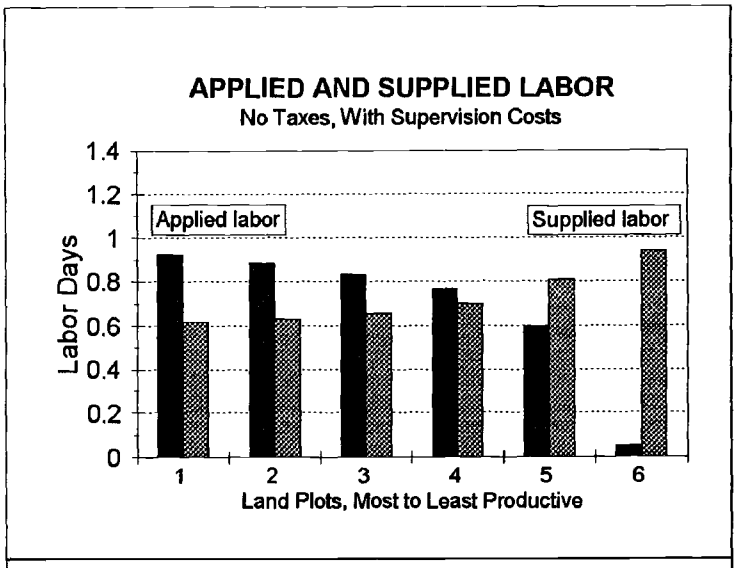


Figure 11

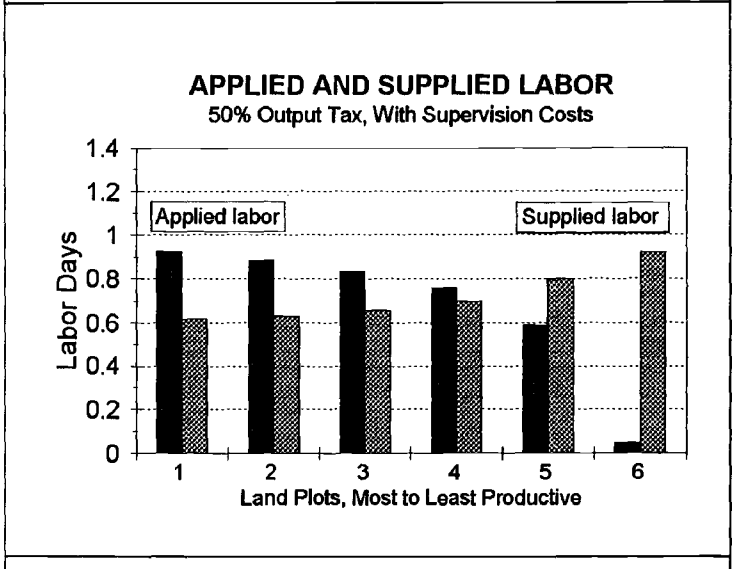


figure 12

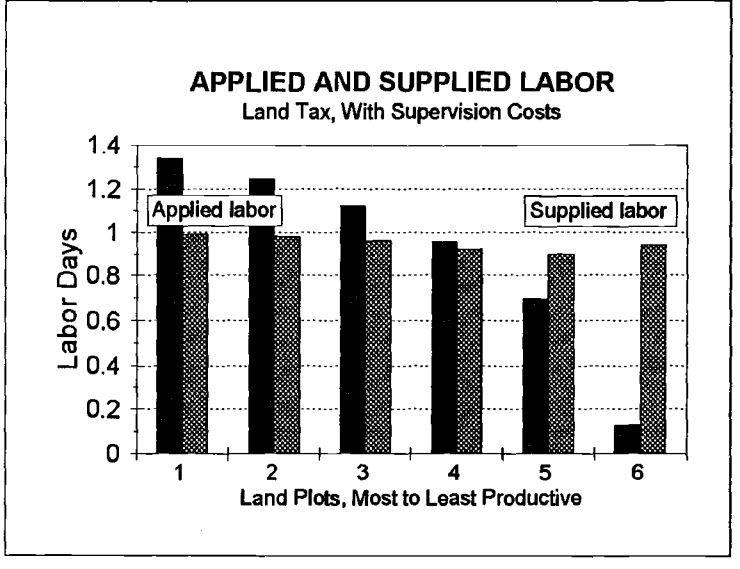


Figure 13

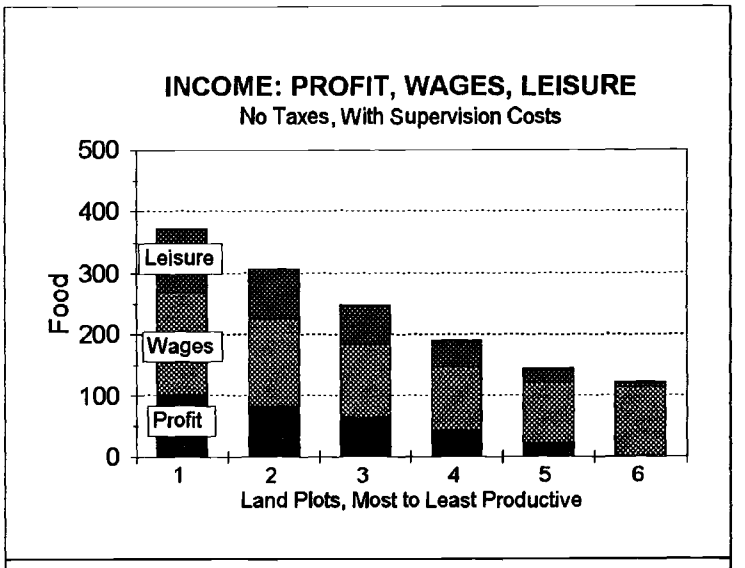


Figure 14

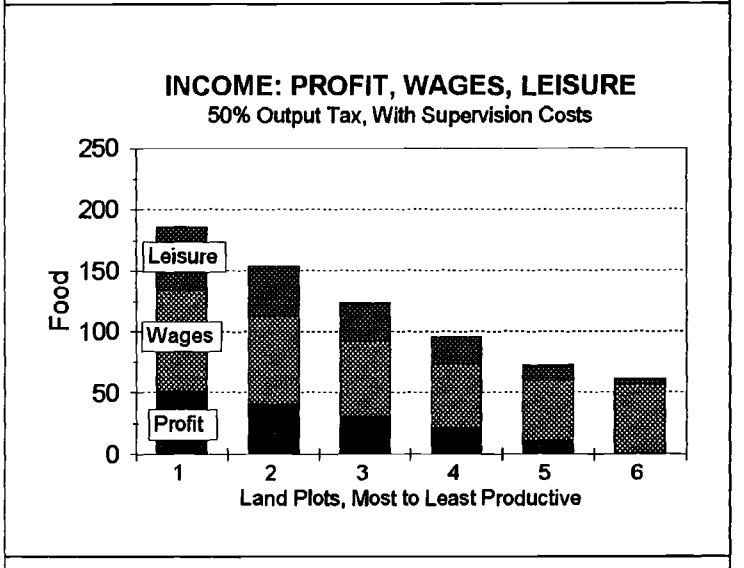


Figure 15

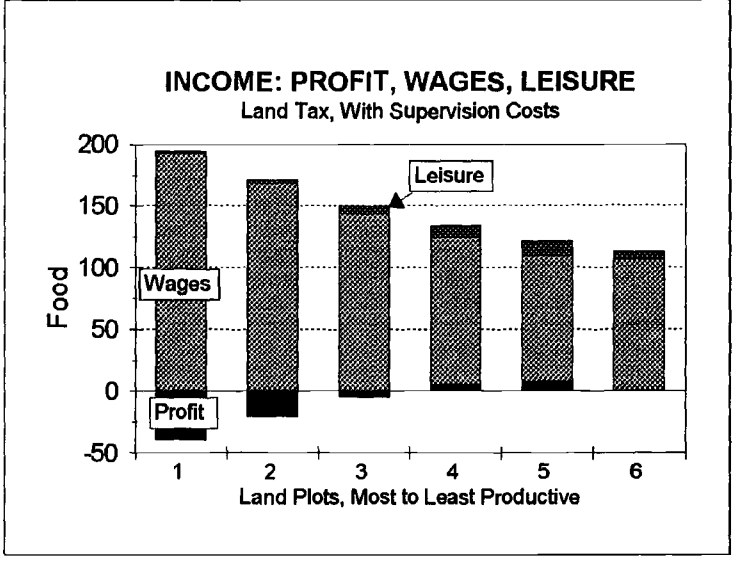


Figure 13 shows income for the six Joes, consisting of profit, wages and leisure, with no taxes. Because there are supervision costs, profit no longer equals rent. Profit is the net over labor costs valued at the marginal product of labor; rent is the imputed net over labor costs value at the market wage. So profit is less than imputed rent wherever there are supervision costs. Figure 14 shows the same for a 50% output tax. Figure 15 shows the impact of an equivalent land tax. Profit has become *negative* for Joes One, Two and Three. Profit is negative because it is net after the 71% tax on the imputed rent. Subtracting the negative profit from the wages of Joes One Two and Three, income distribution is much more equal than with no taxes or the 50% output tax.

Table 2 shows some comparative numbers for Joeland with supervision costs. Curiously enough, it now takes only a 71% tax on gross rent, 245% on net rent, to collect the same amount of tax as a 50% output tax.

Table 2
Comparative Impact of Identical Output and Land Tax
With Supervision Costs

TAX	No Tax	50% Output Tax	245% Land Tax
Total Labor	4.36 Man-Days	4.33 Man-Days	5.7 Man-Days
Hired Labor	1.11 Man-Days	1.09 Man-Days	1.02 Man-Days
Total Output	1059	1055	1305
Tax Amount	0	527	524
After-Tax Output	1059	527	781
After-Tax Income	1383	692	819
Market Wage Rate	122	61	113
Wage Income	747	373	832
Leisure Income	323	164	38
Profit	312	155	-52
Imputed Rent	676	335	214
Gini Coef Income	.217	.216	.063
Gini Coef Rent	.473	.376	.461

III. Joeland With Transaction Costs and Inefficient Tax Collection

In Joelands I and II the output tax clearly can collect more than can the land tax. In fact it can collect the entire output, leaving the Joes to starve. In Joeland I, with no supervision costs, the maximum a land tax can collect is not much greater than the 531 collected by the 98% tax; a 99.99% tax collects 545, the entire rent. So how can the output tax collect more than the rent? Easily, by driving down both the wage and the marginal product of labor in the same proportion everywhere, from the center to the margin. The problem is the assumption of an output tax of Teutonic efficiency, collecting

everywhere the appointed share of every blade of grass. In the real world, tax collectors are inefficient, especially near the margin where the returns to their efforts are small. And producers are good at hiding output from the tax collectors, especially output which they consume themselves. In fact in the real world, the margin is necessarily tax free; taxes at the center however move the margin in or out by raising or lowering the wage.

Figure 16

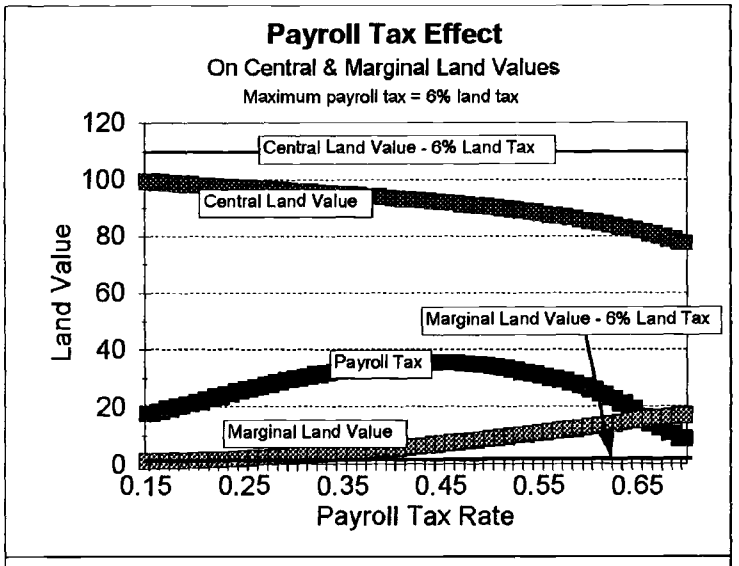
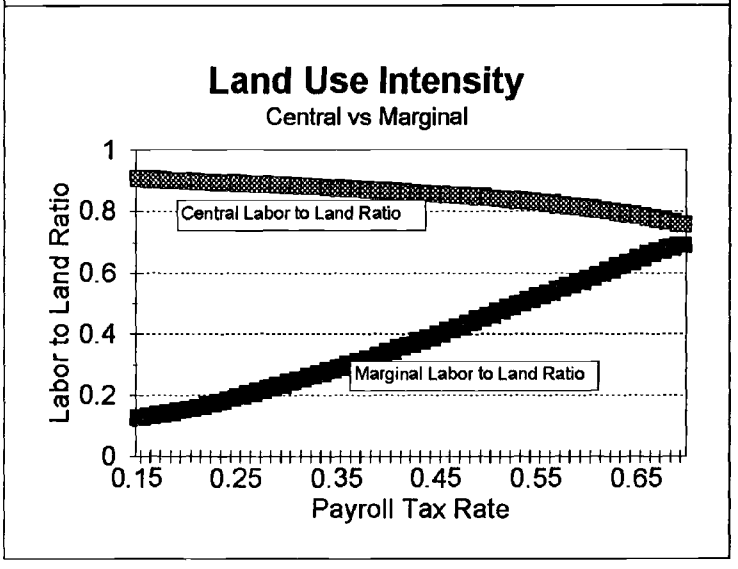


Figure 17



Suppose now the only tax in Joeland is a payroll tax, imposed strictly on hired labor. The tax collector cannot measure or tax an individual's labor on his own land. Figure 16 shows the collections of such a payroll tax as a function of payroll tax rate. Payroll tax collections show a perfect Laffer curve, rising to a maximum at around 40%, and then falling again at higher rates. As the payroll tax rate rises, the Joes increasingly work for themselves, especially marginal Joe Six, avoiding the payroll tax. Figure 16 also shows how the payroll tax affects land values: as the rate increases, central land values fall, while marginal land values rise. A 6% land value tax turns out to collect the same as the maximum payroll tax. With that 6% land tax, central land values are higher, and marginal

land values are lower. In this case, a switch to a land tax will raise central land values and lower marginal land values.

Figure 17 shows how the payroll tax affects land use intensity. As the payroll tax rate increases, the marginal labor to land ratio rises dramatically. Environmentalists take note: inefficient taxes push economic activity out onto land that should be submarginal, including land best left wild.

CONCLUSION

The ultimate effect of a switch to land taxation depends on the efficiency of the current tax system. By efficiency I mean the extent to which people can avoid taxation by moving their activities further out from the economic center--including into the underground economy of central city slums. My sense is that our system is tremendously inefficient; urban sprawl is a concrete embodiment of such inefficiency. This inefficiency also dissipates benefits of economies of scale or urban synergism.

The customers of the major banks tend to hold the best, most centrally located land. A switch to land value taxation may actually deliver to them a temporary windfall of increased land values. Temporary, of course, because land value taxation will immediately put them under great pressure to use the land more intensively. As for smaller banks, land value taxation may sufficiently increase their customers' earnings to compensate, on the average, for the likely collapse of marginal land values. If the events in little Joeland are any guide, a switch to land value taxation will set off such an economic boom that everyone comes out ahead.