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THE PROPERTY TAX: AN EXCISE TAX OR A PROFITS TAX?

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by

Peter M. Mieszkowski

1. Introduction

Two widely accepted propositions of incidence theory are, that the burden of a tax on land falls on the owners of land while a property tax on reproducible capital is shifted to consumers and is equivalent to an excise tax. These results date back to the work of A. Marshall (1897), N.G. Pierson (1902), F.Y. Edgeworth (1925), more recently to the work of H.A. Simon (1943), and are used repeatedly in empirical work, R.A. Musgrave et al. (1951), W.I. Gillespe (1965), and in the literature on housing and urban problems, D. Netzer (1968), (1969). Netzer has expressed property taxes on the housing stock in the nation as a whole as an excise tax on housing services. Also in the national accounts prepared by the U.S. Department of Commerce, property taxes are lumped together with sales taxes and manufactures' excise taxes in the category, indirect taxes.

While the proposition that the property tax is an excise tax represents conventional wisdom there are two opposing points of view. One is that the property tax is very similar, if not fully equivalent, in its distributive effects to taxes on profits. This view of the effects of the

property tax was first developed by H.G. Brown (1924) in a well known, though
neglected section of his book, The Economics of Taxation, and has been re-
stated by Procter Thomson (1965). The second, somewhat different proposi-
tion is that a property tax on improvements (reproducible capital) is shifted
through a reduction of site rents onto owners of land. This argument, first
found in Marshall (1890), has also been recently presented by Raymond Richman
(1967, 1968).[1] The essence of Richman's argument is that a property tax in
a particular city will lead to a less intense use of land there and will de-
crease land values. It is possible to argue that land rents are determined
as a residual, and when a property tax is imposed on capital, developers
will bid less for land, as their normal costs are increased by the amount
of the tax. Also there is the related, more general, argument made by
Rolph (1953) and Rolph and Break (1961) that partial taxes, excise and
property, will be borne in large part by imperfectly mobile factors of pro-
duction.

The main aim of this paper is to attempt to reconcile these opposing
views on the effects of the property tax and to demonstrate that there is
some truth to each of the three general arguments presented above. In par-
ticular, excise tax effects will result from property taxes imposed at
varying rates on different types of property, or in different regions or
cities. Also there is relatively little conflict between the view that

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[1]Marshall argued that a general property tax imposed in all communities
would be shifted to consumers. On the other hand he believed that a partial
tax, imposed in a single community, if not accompanied by improvements in
public services, would fall on land owners as residents would move to es-
cape the tax.

property taxes are excises and the proposition that the basic effect of
the property tax is to decrease the yield from real capital <u>if it is properly
recognized that the global (nation wide) effects of the tax are quite dif-
ferent than the partial effects for a single city, or groups of cities.</u>
Furthermore it is quite possible with reference to a city, or region, that
the price of commodities will rise <u>and</u> land rent will fall in response to
the imposition of a property tax. For a particular city, the decrease in
real income resulting from a tax may well exceed the real value of tax pro-
ceeds.

While our aim is to develop an eclectic analysis of the distributive
effects of the property tax our principal conclusion is that the conventional
excise tax view of the tax is misleading and inaccurate. From a national
perspective the basic effect of the imposition of property taxes by thousands
of local governments is to decrease the yield on reproducible capital.
Relatively high tax rates in certain cities increase the prices of goods
and services produced in these localities. However these price increases
will be tempered, even swamped, by decreases in the value of land and de-
creases in the returns to other imperfectly mobile factors of production.
Nevertheless, the discentive effects of property taxes, often stressed
by the critics of property taxes, are very real. Unless increases in the pro-
perty tax rates in a particular city are accompanied by improvements in the
quality of public services, residents will have an incentive to move, the
size and quality of the housing stock will deteriorate, and the location
of industrial activities in high tax jurisdiction will be discouraged.
The disincentive effects of the property tax are a relative matter. All

local taxes unless they are imposed on immobile factors such as land will produce cost increases that discourage local activities.

2. The Effects of Equal Rate Property Taxes

The results in this paper are based on models in which product and factor markets are perfectly competitive, and factors receive the value of their marginal products. The per-unit returns will be the same for each factor in each industry. The marginal productivities of factors depend on the technologies of different industries, the demands for various commodities and the relative endowments of land, labor and capital. Money and other financial complications are omitted, the yields on all assets are assumed to be known with complete certainty, and it is assumed that the total supplies of labor and capital, as well as land, are fixed. Throughout the analysis we assume that capital is perfectly mobile between industries and different areas so in equilibrium the after-tax rate of returns on all capital in the economy are equalized.

A distinction should be made between the gross rentals on different types of capital, which are determined by the marginal productivity of capital, and the yield, or the rate of return on capital (the rate of interest). The rate of return is defined as the rate of discount, which equates the rentals (gross profits) on a particular asset to its cost of production. Since we are in a world of complete certainty all assets will yield the same rate of return and loans such as mortgages, corporate debt, etc., will be made at this rate. The reproduction cost of capital is the cost of producing a unit of capital such as a house or a machine. While the market

value of a shiftable capital good may exceed its reproduction cost temporarily, the value of capital, in a particular location, can remain permanently below its reproduction cost. For example, if taxes are raised, unexpectedly, in a particular town, new construction will cease, the tax will be capitalized and houses will sell at a price below the cost of reproduction.

In the absence of taxes the required rate of return, or the supply price of capital will be the same for all industries in all communities, and will equal the rate of interest. If different industries are subject to varying rates of profits tax the required rates of return will vary by the amount of the tax differentials, as owners of capital will allocate their capital goods to equalize after-tax rates of return.

Throughout most of the analysis we shall abstract from the effects of the expenditure side of the budget. The only justification of this simplification is convenience, as the level and quality of public expenditures influence housing values and locational decisions. However, if we were to consider the expenditure side we would have to specify the value placed on a particular bundle of services, by different groups for varying rates of tax and to recognize that varying tax bases between communities leads to different levels of public services for the same tax rate. To avoid these complications we make the conventional simplification of taking the budget as given, essentially ignore it, and attempt to determine the change in factor and commodity prices that result from a particular method of finance and compare these distributive effects with

those derived for alternative tax regimes.[2] Nevertheless it is important

to bear in mind that throughout the analysis we evaluate changes in factor

prices and site values without allowance for the effects of public expen-

ditures. In a short concluding section we shall show how the results might

be reinterpreted if the expenditure side of the budget is accounted for.

The basic decision making unit is a city or town.[3] Assume, initially,

that all cities in the nation impose the same rate of property tax on all

income producing capital, industrial, commercial, residential, and on land.

Since factor prices equal marginal products, a flat rate property tax on

all land and capital in the nation will be paid out of land rents and pro-

fits in proportion to the factors' original share in income. As long as

local government spends the proceeds in a distributionally neutral manner

(in the production sense), or equivalently another tax of equal yield is

decreased, the imposition of a general property tax system will not have

any effect on relative commodity prices and as we are abstracting from the

expenditure side of the budget there will be no incentive to change the

location of residential and industrial activities. Any attempt to shift

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[2]Deductive work in this area is much easier than quantitative work where
it may be necessary to account for both the benefit (expenditure) and the
cost (tax) side simultaneously. In an empirical study where one tries to
allocate benefits and tax burdens to different income groups a separation
between the two sides of the budget is possible. However in econometric
studies of the effects of the property tax on housing values and rent levels
such as the ones recently carried out by Orr (1968), Oates (1970) and
Heinberg and Oates (1969) with aggregate data on different cities have to
control for the quality of public services as well as effective tax rates
and other variables.

[3]Throughout the analysis we abstract from the effects of the property tax
on the agricultural sector.

the property tax will be frustrated. For example, a rise in commodity prices relative to wages results in a decrease in real wages, relative to the value of the marginal product of labor, and will lead to an increase in the demand for labor that will restore the real wage to its previous level.

As all capital goods and land are subject to the same tax owners of wealth will have no incentive to alter their portfolios. Capital accumulation is assumed to be independent of tax changes so the before-tax rentals of capital goods and the reproduction cost of capital goods are unaffected by the imposition of the tax. Asset prices will remain unchanged and the rate of return (rate of interest) will fall in proportion to the size of the property tax.

Contrary to the conventional wisdom the imposition of a general property tax does not increase the price of housing services. Although owner occupants have to pay a property tax the price of rental housing is not increased. The cost of housing for the owner-occupant also remains unchanged, as the opportunity cost of capital falls by the amount of the tax, leaving total housing costs unchanged. Changes in the relative income positions of different groups are due solely to the different amounts of wealth that they own. A renter who does not own any wealth will not bear any of the burden of the property tax. An individual who owns a $20,000 house and another individual who owns $20,000 worth of manufacturing equipment will both bear the same tax burden.

Furthermore for the special case under consideration the property tax is not a benefit tax. Households pay taxes only in their role of owners of capital. When an initial equilibrium where the tax rate is the same in

all communities is disturbed by a change in preferences, all communities
increase public expenditures, and to finance these expenditures all cities
increase the tax rate by the same amount, the additional tax burden will
fall on owners of capital. The overall marginal productivity of capital
is not changed by an equal increase in tax rates in all communities. In
the extreme case where all capital is owned by a single individual and all
towns are composed of renters the benefits of the higher public expenditures
will be enjoyed at the expense of the capitalist.

3. The Excise Tax Effects of Property Taxes

The results of the previous section are highly stylized by the assump-
tion that all towns tax all capital at the same rate. In fact, thousands
of local governments and special districts impose property taxes at different
rates with different coverage, and with varying assessment practices.[4]

Tax rate differentials between communities result in excise tax effects.
These effects are the result of the perfect mobility of capital which equalizes
after-tax rate of return in all communities. A town, which because of a
higher than average propensity, or need, to spend on public goods and services,
imposes a relatively high rate of property tax on housing will pay more for
the services of housing capital. If certain communities impose a relatively
high property tax rate on industrial capital, the cost of capital to these
industries will rise and, depending on the competitive position of the industries

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[4]Morris Beck (1963) analyzed the effective property tax rate for about one
hundred communities in Northeastern New Jersey and found effective tax rates
varying from less than 1% to over 7%.

in the high tax communities vis-a-vis firms in other areas, the price of
the products of the heavily taxed industry will rise, and/or wages and the
returns on land will have to fall so that the industries in the high tax
town can remain competitive.

In short, it is the existence of tax differentials between communities
that leads to either an increase in certain commodity prices and/or to a
fall in wages and land rentals. This is one of the main points of this
paper. Higher housing rents and higher costs of other locally produced
goods and services are due to increases in the cost of capital resulting
from property tax rates which are above the average for the country as a whole.
I believe the effects which result from tax differentials are more important,
for an understanding of the "shifting" of the property tax, than are monopoly
power and/or a response in the overall supply of capital.

In order to emphasize the excise tax effects of property tax we abstract
from possible changes in the return on mobile factors by making a number
of restrictive assumptions. First that there are no "economies of scale"
associated with high density industrial and residential development, and
transportation costs are negligible. Capital and workers are perfectly mobile
between communities so that the after-tax return on capital and the wage
rate are equal in all communities.

Although there is little relation between place of work and place
of residence, different households prefer, for a given set of housing prices,
different residential locations (cities). If relative housing prices change
some of the households will change their place of residence. I also assume
that each town is surrounded by farm land and that the supply of land from

agriculture to urban use is perfectly elastic at the opportunity cost of

the land in agriculture. This last assumption helps to insure that tax

induced changes in residential locations will not affect land rents and

land values. Adjustments in the relative size of various cities will take

place through changes in the amount of land taken out of agriculture.

Finally it is assumed that industries are specific to particular towns so

that there is no wholesale relocation of industries between towns. This

last assumption is particularly tenuous in light of the assumptions of per-

fect capital and labor mobility and the absence of locational advantages.[5]

Consider the case where different cities levy a varying rate of tax

on capital used in the production of "home goods," i.e. residential capital,

trade and services, but each city taxes industrial capital used in the pro-

duction of export goods, at the same rate and the common rate of tax on

industrial capital is equal to the average rate of tax on residential capi-

tal (home goods) in the economy as a whole.

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[5]Changes in industrial location of industries are sluggish as industrial
capital, especially structures, have long-lives. This immobility of capi-
tal raises the possibility that an increase in the property tax, by a parti-
cular city, on existing industrial capital will be capitalized which is
contrary to the argument that the tax-induced increases in the cost of
capital services will increase the cost of commodities produced in high
tax jurisdictions. If different components of a firm's capital stock come
up for replacement at different points in time, it may never pay to move
as there will always be a large amount of complementary capital which has
a useful economic life. However the choice of technique for the process
under replacement will be based on a cost of capital calculation that re-
flects the higher property tax. Consequently as capital is replaced over
time bit by bit the after-tax rate of return on capital will be restored
to its previous level. These assumptions about the nature of depreciation
and replacement help make the assumption of location specific industries
a little more realistic.

The average rate of tax on residential capital for the nation as a whole is the tax in each community weighted by the amount of capital subject to tax. For example in the symmetrical situation, where there are three towns, A, B, C, and town A taxes 1,000 units of residential capital at a rate of 2%, B has a 3% rate of tax and 10,000 units of capital and C, the high tax town has a tax rate of 4% and 1,000 units of capital. The simple, and weighted mean of the tax rate is 3%, and by assumption this is the common rate of tax imposed on industrial capital. Suppose that before the imposition of the property tax system the before-tax rate of return on all capital was 10%.

After the imposition of taxes residents of high tax communities will decrease their demand for residential capital and some households will shift their residential capital to low tax areas. The tax-induced change in the allocation of residential capital may take place at an unchanged rate of return on capital. This will depend on whether the tax induced decrease in the demand for capital in high-tax towns is just offset by an increase in the demand for capital in low-tax towns. When the before-tax rate of return on capital remains unchanged after-tax rates of return on capital fall by the average rate of tax, i.e. from 10% to 7%. On the other hand, if the capital which shifts out of high tax communities cannot be absorbed in low-tax areas at an unchanged before-tax rate of return the overall tax rate will fall. Suppose this occured and the before-tax rate of return on capital fell from 10% to 9.5%. The burden on owners of capital will be larger than the average tax rate of 3%. Consumers of industrial commodities and housing services will benefit from the decrease in real profits that does not accrue to government.

Regardless of whether the overall before-tax of return is decreased,
increased, or unchanged by the tax, and we shall assume for simplicity that
it remains unchanged, there are two basic effects of a system of property
taxes imposed at varying rates in different communities. The first is to
decrease the after tax return on capital by an amount that approximates
the average rate of property tax in the economy. The second effect is to
increase the cost of the services of capital in high areas and to decrease
its cost in low-tax communities for capital markets will not be in equili-
brium unless the after-tax rate of return on capital is the same in all
communities.

In our example community C, the high tax town, imposes a tax rate
of 4%, while the national average is 3%, and while the global effect of
the property tax system is to decrease the after tax return on capital from
10% to 7%, the required rate in community C increases from 10% to 11%.
The eleven percent is made up of an interest rate of 7% plus a property
tax of 4%. Consequently, relative to the situation where no community
imposes property taxes the cost of capital has increased by a percentage
point in community C. If capital is the only input in the production of
housing services, the price of these services (rents) in C will go up by
10%. In community A, whose tax rate is 1 percentage point below the national
average of 3%, the cost of housing will go down by 10% relative to the zero
tax situation.

The existence of negative as well as positive excise tax effects
resulting from property taxes is important for empirical work which allocates
tax burdens to groups classified by income level. Ideally, one should work

with income distributions for each separate taxing jurisdiction. But if
this is not feasible and when the correlation between the level and distri-
bution of income in various communities and the level of property tax is
weak it will not be inaccurate to ignore the excise tax effects and to treat
the property tax as a profits tax. For if the shape of the income distri-
bution is the same in low tax towns as in high tax towns (in actual fact
it is probably not) excise tax effects at the global level will cancel for
each group at a particular level of income.

These results permit a reconciliation of the view that the property
tax is shifted to consumers with the proposition that the burden of a pro=
perty tax falls on profit income. Residents of high tax communities will
pay more for housing while residents of low-tax communities will obtain
housing at lower prices which prevailed when property taxes are not imposed.
The basic distinction that needs to be emphasized is between the global
effects of the property tax with its effects at the city or state level.
At the national level the excise effects of the property tax may be of
secondary importance, and overall profits are decreased by the average rate
of tax. However, for a single city which may impose or increase the property
tax the effects are quite different and approximate the conventional wisdom
on the distributive effects of property tax. Regardless of a city's original
situation vis-a-vis other cities, an increase in its rate of tax will in=
crease the cost of services of capital by the amount of the tax. Thus if
all cities, except one, impose a tax of 3% and the remaining town originally
has a property tax rate of zero the imposition of a 3% tax by this town will
eliminate its relative advantage and will increase the cost of capital there

by 3 percentage points. The town whose rate of tax was originally zero
does not pay more for the services of capital goods, after it adopts the
tax, than it would if no city used the property tax. However, when a town
imposes or increases the tax on property the price it pays for the services
of capital will increase by the amount of the tax.

The same point can be made in a different way. When cities impose
the same rate of tax, the property tax is not a benefit tax from the global
point of view as the burden of the tax falls on capitalists who consume only
a small part of public goods and services that are financed with the tax
proceeds. On the other hand for a town acting independently on other towns,
the burden of the property tax will fall on its residents in proportion
to their consumption of the services of capital. In this sense the property
tax is a benefit tax.[6]

There is no inconsistency between the view often expressed in the liter-
ature that the use of the property by a particular community raises the
cost of housing and other goods produced for local consumption in that city,
and the result that the elimination of the property tax by all communities
would increase the rate of return on capital. In other words while it is
quite correct to say that the marginal effect of a property tax of 3% in
New York City (or any other city) is to increase the cost of capital ser-
vices in N.Y.C., even though all other cities impose a tax of 3%, it is
wrong to leap from the partial statement made with reference to a particular

[6]For the moment we ignore the possible complications arising from the dif-
ferential taxation of industrial capital by a single city.

city to statements for the nation as a whole. From the global perspective
a 3% tax on capital in each city is a 3% tax on the earnings on capital.

To this point we have abstracted from changes in relative prices
in the industrial sector by assumption that all cities tax industrial capital
at the same rate, which is equal to the average tax on residential capital.
Apart from the need of weakening the assumptions on the perfect mobility
of labor, the constant rent on all land and that all industries are location
specific the effects of property taxes imposed at differential rates are
likely to be more complicated than those of the taxes imposed on production
of home goods. Capital intensities will vary more between industrial sectors
located in various towns and in the production of home goods and there is
a greater possibility of substituting labor for capital in industrial ac-
tivities than in residential real estate, trade, and services. Also there
is the problem of specifying the elasticity in demand of the industrial
output of different communities. Some communities may have substantial
monopoly position in their commodities while other towns will be in highly
competitive situations vis-a-vis other towns. Nevertheless, the production
effects will tend to cancel out in the aggregate if there is little or no
correlation between the production parameters of specific industries (the
relative factor intensities and the relative size of the elasticities of
substitution) and the property tax rates imposed on different industries.
When this correlation is weak capital released from the industries located
in high tax towns will be absorbed in industries subject to low rates of
tax without an appreciable change in the average before-tax rate of return
on capital. On the other hand if high tax areas produce predominately capital

(labor) intensive commodities and the elasticities of substitution are re-
latively high (low) in these industries the average rate of return on in-
dustrial capital will fall (increase).

As in the analysis of taxes on home goods it is important to measure
the excise tax effects of property taxes on industrial capital relative
to the mean rate of tax on this type of capital. If the average property
tax rate on industrial capital is 3% and the shoe industry is taxed at a
rate of 4%, the price of capital to the shoe industry will be 1 percentage
point higher. If the average before-tax rate of return is 10% and the share
of capital is .25%, the price of shoes will increase by 2.5%. The relative
prices of commodities produced by industries, subject to tax rates below
the mean rate for industrial sector, will fall and as in the case of resi-
dential capital excises taxes tend to cancel, with some commodities increasing
in price and others decreasing in price. In empirical work these excise
tax effects are important when commodities taxed at below average rates
are disproportionately important in the consumption patterns of specific
income groups. If there is no such relationship the excise tax effects
for industrial commodities are of secondary importance.

We have discussed separately the excise tax effects of property taxes
on residential real estate and on industrial property. Assumptions were
made to minimize the possible changes in overall rates of return on capital
within each of the two broad sectors. In fact, capital is mobile between
industry and residential real estate and the possibility of tax differentials
between broad industry groups must be accounted for. Housing services,
in the aggregate, may be taxed more heavily than industrial capital or vice-

versa. If this is true the price of housing in general will rise relative
to the price of industrial goods; there will be a reallocation of resources,
and since housing is very capital-intensive the price of capital will fall
relative to the price of labor. Consumers of housing services and owners
of capital suffer a loss in real income while consumers of other goods ex-
perience an increase in real income as a result of a decrease in the price
of commodities other than housing services.[7]

4. The Immobility of Labor, the Capitalization of Property Taxes and Their Effects on Land Values

The major qualification to the result that local tax differentials
increase or decrease the price of locally produced goods and services by
the changes in the cost of capital services is the possible decrease in
the returns to imperfectly mobile factors of production.

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[7] For an analysis of the incidence of partial factor taxes by means of a
two-factor, two-commodity model, see A.C. Harberger (1962) and P. Mieszkowski
(1967). The data presented by Netzer (1966) Tables 2-4, 2-6, 2-7, indicates
that the effective property tax as a percent of assets valued at replace-
ment cost is found to be quite similar for broad industry groups. Assuming
that only 1/2 of inventories are subject to tax(1/2 of the states exclude in-
ventories from the tax base) we find the following effective rates: total
non-farm business 1.22, utilities and transformation 1.30, non-farm housing
1.28, trade, finance and services 1.19, manufacturing 1.07, agriculture .83.
These aggregative figures mask considerable variation in rates for finer
levels of aggregation.

L. Rosenberg (1969) measuring capital on an original cost basis found con-
siderable variation in the effective property tax rates ranging from a high
of 2.89 in furniture to a low of 1.16 in tobacco manufactures.

We have assumed that reproducible capital is perfectly shiftable. This assumption is quite plausible in a growing economy as the allocative effects of taxes will work themselves out through adjustments in the location of investment (new construction).

Nevertheless, as structures have long lives and new construction may be insignificant in certain cities the market value of capital may fall, and remain below its reproduction costs for indefinite periods of time. Consider a number of older central cities where the land is fully developed and new construction takes place only in the suburbs. If taxes are relatively higher in central cities tax differential will be reflected in lower market values of the capital goods. For example a house which costs $20,000 to produce in the suburbs is taxed $100 a year less than an identical house located in the central city, and if this differential is expected to persist indefinitely, the central city house will sell at a "discount" of $1,000 when the rate of interest is 10%. Unlike the situation where prices quickly rise in response to a decrease in the supply of new housing, the outflow of capital, in a city where there is no new construction, will be limited to depreciation and deterioration.

The housing stock can be classified according to its quality, which will usually be correlated with age; the impact effect of an increase in the property tax will be to hasten deterioration by discouraging replacement and maintance investments. For the set of rents that existed before the imposition of the tax, new construction will be lower, some of the stock that would be maintained at a given quality level will be allowed to deteriorate to the next quality class. The units of lowest quality will be retired

(abandoned) sooner, and so on. The average quality-adjusted rent for housing will increase. The speed at which capital can be shifted from a high tax location is largely a technological datum but will also depend on demand considerations. For example, if the middle class will not tolerate a deterioration in quality because of the availability of housing in an alternative location and if there are no prospects of renting the units at a reduced level of quality to lower income groups the units will be maintained at their previous level of quality. Housing rents will remain unchanged and the higher property tax will be capitalized. On the other hand, there will be little, if any, capitalization of the tax when it is possible to transform the units to more intense use and to wear out (shift) the capital more quickly.

Even if capital is perfectly shiftable the property tax may be fully capitalized in the value of land. For example if the present value of property tax in town A on a house which cost $20,000 to produce is $1,000 larger than in town B it is expected that a lot in A will sell for $1,000 less than an identical lot in B.[8]

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[8] One of the unrealistic aspects of the assumption that rent on urban land is determined by the opportunity cost of land in agriculture is that in most communities agriculture is not a viable alternative as undeveloped land consists of a number of small scattered plots. The value of urban land will be determined strictly by urban uses and taxes will play a role in the determination of the value of undeveloped urban land. In this connection it is important to note the work of Oates (1970) and Heinberg and Oates (1970) on the capitalization of property taxes. For a sample of cities in New Jersey and Massachusetts these studies find that the average value of owner-occupied houses in different towns are sensitive to expenditures or school and varying tax burden, and largely offset one another. For a given level of expenditures an increase of future tax payments of $1 dollar (on a present value basis) will decrease the value of housing by exactly that amount. While there is some question whether the authors have "sorted out" various interdependences arising from the need of imposing higher taxes in poorer towns, these results suggest that the owners of capital bear the differential burden of property taxes. The fact that the tax is fully capitalized for

Similarly a potential developer of an apartment house or some other activity will consider property taxes as costs and will subtract them in bidding for prospective development sites.

This simple line of reasoning leaves out three interrelated considerations. First the ratio of improvements to land can be varied in both residential and industrial activities. As is well known from the work on urban structure, (Mills (1967), Muth (1969)) high land rents close to the central business district resulting from low transportation costs to work places will lead to high density apartment developments and the rental of these units by households who derive little utility from the consumption of land space. On the other hand families with children will incur higher transportation costs to "consume" large lots in the suburbs where land is cheaper. If a central city increases its property tax rate relative to suburban tax rates there will be a shift in residential and industrial capital to the suburbs. However the fall in land rents will be buffered by increases in the amount of land used by households who chose to remain in the central city and by industry that will substitute cheaper land for higher-cost capital. Although the price of land will fall the decrease in before tax rents may be significantly smaller than the additional tax on improvements.

(footnote 8, continued) owner-occupied housing implies that the implicit rents on these houses are determined independently of taxes (though they depend on the level of expenditures) and suggests that the tax burden of a property on rental housing falls on the landlord. If there is new construction in each town these results support the proposition that landowners bear the tax differential on improvements in addition to the taxes imposed on the value of land.

A second consideration cuts the other way. Land in the central business district may be viewed as a base for buildings of indefinite height. On some tracts of land a hundred story building can be built just as readily as a five story building. If the tax induced increases in the cost of providing floor space at the CBD lead to a dramatic decrease in the amount of space demand land rents may fall by an amount which exceeds the tax collections in improvements. For some uses of land there need be no close connection between taxes on improvements and changes in land rents.

Finally, a good part of tax burden on improvements may fall on labor which may be imperfectly mobile. Taxes on industrial capital by decreasing output decrease the demand for labor and labor may have to take a cut in wages to remain fully employed.

We shall not attempt to formalize the relationship between the demand for land and the cost of land in residential activities beyond writing the simple aggregate system

$$H = f(p_K, r_1, r_2) \qquad (1)$$

$$\overline{R} = g(r_1) \qquad (2)$$

$$\overline{R}H = R \qquad (3)$$

Equation (1) describes the number of households locating in the central city as a function of the cost of the services of capital, p_K, the cost of land in the central city, r_1, and the cost of land in the suburbs, r_2. $\overline{R}$ is average amount of residential land used by a household residing in the central city and depends on land rents. Equation (3) is the supply constraint for the total amount of residential land R, in the central city.

As the cost of capital p_K is determined in national capital mar-
kets a per-unit tax on capital at the rate, T, would increase the cost
of capital by that amount. This increase induces some households to move
and balance in the land market will be restored by a fall in the price of
land. The moderating influence of an increase in the demand of land con-
sumed by each household is represented by equation (2). If this effect
is small the fall in land prices will approach the increase in taxes on
improvements, otherwise the available amount of residential land would not
be fully utilized.

In order to deal simultaneously with changes in land prices and wage
rate we present a conventional production function approach to the deter-
mination of factor prices where land is treated as an ordinary factor of
production.

In this formulation all sites within a city are identical, a central
business district (CBD) does not exist, and in equilibrium the rent on land
in all activities, high-rise residential, single-family residential, commercial
and industrial will be the same. The size of buildings, per unit of land
space, will depend on whether marginal cost of floor space increases with
the size of the building, and on the return to the complementary services
of land, such as working space, recreational uses of land in apartment house
developments and so on. The marginal revenue product of capital on a given
plot of land is expected to fall as the size of the building is increased.

To make things as simple as possible all activities of a city are
aggregated into a single output x, which is produced with inputs of labor,

L_x , capital, K_x and land, R_x .[9] The supply of labor is taken to be a function of the local wage rate w , and the demand for local commodities is a function of the price of local prices, P_x . There are three factor demand relations, for labor, land and capital, which are a function of the three factor prices and the level of output x . Only two of the factor demand relations are independent. The after-tax return on capital, P_K , given by national conditions, is taken as the numeraire.

The model is a system of six equations in six unknowns, L_x , K_x , x , P_X , w , and r , the rent per-unit of land, and an exogenous tax expressed as a per-unit return on capital, T . The supply of land R_x is taken as fixed. The six equations are as follows

$$x = f_1(L_x, K_x, R_x) , \quad \text{supply of } x \text{ (production function)} \quad (4)$$

$$x = f_2(P_X) \quad , \quad \text{demand for } x \quad (5)$$

$$K_x = f_3(w, r, T, x) , \quad \text{demand for capital} \quad (6)$$

$$L_x = f_4(w, r, T, x) , \quad \text{demand for labor} \quad (7)$$

$$L_x = f_5(w) \quad , \quad \text{supply of labor} \quad (8)$$

$$P_x = f_6(w, r, T) \quad , \quad \text{price relation} \quad (9)$$

---

[9] The aggregation of home goods and industrial activities, into a single output omits an important feature, the possible differential change in the prices of the two broad commodity classes, home goods and exports. However, little is lost through the aggregation in the understanding of the effect of property taxes on factor prices and the effects of different technologies on these changes.

The main qualitative result implied by this model is that changes

in the tax rate T can lead to a very wide range of changes in the returns

to the imperfectly mobile factors, labor and land. It is even possible

though not probable, especially for land, that a tax on improvements will

increase the returns to labor and land relative to the fixed after-tax re-

turn to capital.   The imposition of property tax increases the cost of

the services of capital and this change in relative factor prices results

in a substitution of labor and land for land. While the demand for labor

and land will be increased at each level of output, the level of economic

activity in the city will be decreased by the property tax. The output

effect decreases the demand for land and labor for any set of factor prices.

Consequently the effect of the tax on the returns to labor and land is

ambiguous in sign and in magnitude. When the output effect dominates the

factor substitution effect, as it probably will, the returns to labor and

land fall relative to the after-tax return on capital. Nevertheless the

decrease in the return to these immobile factors will be quite modest if

the demand for these factors is sustained by the substitution of labor and

land for capital. Of course the more elastic is local demand to price in-

creases the more powerful will be the output effect. The change in the

relative changes in the returns to land and labor depend in part on the

supply response of labor to changes in the wage rate.

When land and labor are both perfectly immobile the change in the

relative prices of labor and land depend on the relative responses in the

demands for these two factors to changes in their prices and to the change

in the cost of capital. If the factor substitution possibilities are much

greater for labor than for land, the price of labor will increase relative
to the price of land. More generally sharp divergence in the returns to
labor and land (when both factors are immobile) is possible only if the
demand for one of two immobile factors is much more responsive to changes
in factor prices.

To investigate these possibilities more precisely we differentiate
equations (4)-(9) totally with respect to T, and with appropriate sub-
stitution reduce the six equation system to two equations in two unknowns,
dw/dT, and dr/dT.

$$(10)$$

$$(f_K(a_{KL} - a_{RL}) + f_L E_L - E_x f_L) \frac{dw}{dT} + (f_K(a_{KR} - a_{RR}) - E_x f_R) \frac{dr}{dT} = (f_K E_x - f_K(a_{KK} - a_{RK})$$

$$(a_{LL} - a_{RL} - E_L) \frac{dw}{dT} + (a_{LR} - a_{RR}) \frac{dr}{dT} = (a_{RK} - a_{LK}) \quad (11)$$

where f_K, f_L are the original shares of capital, labor and land respec-
tively. E_L is the elasticity of supply of labor, E_x is the price elasticity
of demand for x.

The a_{ij}'s are the elasticities of the demand for factor i with
respect to a change in the price of factor j. The a_{ij}'s involving labor
and capital are interpreted as partial elasticities of substitution as de-
fined by Allen (1950) where a_{ij} is the partial elasticity of substitution
between factor i and factor j (cost) of the factor weighted by the pro-
portion of factor j in total cost. I.e. a_{KL} is $f_L e_{KL}$ where e_{KL}
is the partial elasticity of substitution between capital and labor. Allen
defined the partial elasticity of substitution a_i, $i \neq j > 0$ and
a_{ij}, $i = j < 0$, and he showed $a_{LL} + a_{LK} + a_{LR} = 0$ and $a_{KK} + a_{KL} + a_{KR} = 0$

We leave open whether the demand for land with respect to its own price, a_{RR} is zero if there is no possibility of substituting labor and capital for land directly in the production of x, i.e. $a_{RK} = a_{RL} = 0$. In deriving equations (10) and (11) we make use of the convention that the original prices of all factors are equal to 1 and also utilize the relation for percentage increase in the demand for land, dR/R (which must equal zero as the supply of land is taken fixed) and express the demand for labor and capital relative to the demand for land.

Solving equations (10) and (11) for dw/dT and dr/dT we obtain

$$\frac{dw}{dT} = \frac{(f_K E_x - f_K(a_{KK} - a_{RK}))(a_{LR} - a_{RR}) + (a_{LK} - a_{RK})(f_K(a_{KR} - a_{RR}) - E_x f_R)}{D} \qquad I$$

$$\frac{dr}{dT} = \frac{-(f_K E_x - f_K(a_{KK} - a_{RK})(a_{LL} - a_{RL} - E_L) + (a_{RK} a_{LK})(f_K(a_{KL} - a_{RL}) + f_L E_L - E_x f_L)}{D} \qquad II$$

where the denominator D is equal to

$$D = (f_K(a_{KL} - a_{RL}) + f_L E_L - E_x f_L)(a_{LR} - a_{RR}) - (a_{LL} - a_{RL} - E_L)(f_K(a_{KR} - a_{RR}) - E_x f_R)$$

The presumptive signs of E_L and E_x are positive and negative respectively and it is easy to show that the sign of D is unambiguous positive.

The signs of the numerators of expressions I and II are ambiguous. The signs of the first terms in the expressions for dw and dr depend on relative magnitudes of $f_K E_x$ and $f_K(a_{KK} - a_{TK})$. $f_K E_x$ reflects the decrease in the demand for x resulting from the imposition of per-unit tax on capital in x. We have referred to this effect as the output effect.

The term $-f_K(a_{KK} - a_{TK})$ reflects the substitution of land and labor for capital as a result of the increase in the cost of capital resulting from the tax.

In large measure the signs of dw/dT and dr/dT depend on the relative magnitudes of the output and factor-substitution effects. The output effect works against capital and labor and the factor substitution effect works in their favor.

In addition the changes in the returns on capital and labor depend on the relative degree of substitutability between of labor for capital and land for capital, i.e. on the sign of $(a_{LK} - a_{RK})$. If as expected $(a_{LK} - a_{RK})$ is positive the second term of the numerator of the expression for dw/dT is unambiguous positive. When in addition $(a_{KL} - a_{RL})$ is positive the second term in the numerator of II is unambiguously negative.

As factor substitution terms appear in both the numerators and denominators of expression I and II it is uncertain what effect the magnitude of these parameters will have on the absolute value of dw/dT and dr/dT. On the other hand the effects of these parameters on relative magnitudes of dw/dT and dr/dT are easier to interpret.

By rewriting equation (11) dr/dT is expressed in terms of dw/dT

$$\frac{dr}{dT} = -\left(\frac{a_{LL} - a_{RL} - E_L}{a_{LR} - a_{RR}}\right)\frac{dw}{dT} + \left(\frac{a_{RK} - a_{LK}}{a_{LR} - a_{RR}}\right) \tag{12}$$

Assuming $a_{RK} - a_{LK}$ to be negative it follows from equation (12) that when dw/dT is negative the fall in r relative to w will be less the more responsive is the demand for land to changes in the price of

land. When dw is positive it is unclear, because of the constant term, whether it will be to the benefit of landowners (relative to workers) for $(a_{LR} - a_{RR})$ to be as small as possible. Nevertheless it is quite likely that the less elastic the demand for land with respect to its price the larger will be the increase in the return on land relative to the increase in wages. There is a straightforward interpretation to these results. If wages fall as a result of a tax-induced decrease in economic activity the fall will be cushioned by the possibility of substituting labor for land and capital. If the factor substitution possibilities are smaller for land than for labor the price of land will fall more. On the other hand when the demand for labor and land both rise the return to labor will increase relatively less as the demand for this factor is more elastic with respect to changes in its price.

The close connection between the price of land and the wage rate also serves to explain the curious result that the price of land does not necessarily fall more when the supply of labor is more responsive to wage rate changes.

As E_L, the elasticity of supply of labor with respect to wage rate change appears only in the denominator in the expression for dw/dT the wage rate will necessarily fall less when the supply of labor to the city is more elastic. However it does not follow from (12) that an increase in E_L, which leads to a decrease in dw/dT, will necessarily increase (decrease) the magnitude of dr/dT. It is expected that a smaller decrease in the wage rate due to mobility of labor (assuming dw/dT negative) will depress the demand for x and will decrease land prices. Working counter to this effect is

the increased demand for land as a result of the smaller fall in wages.
The possibility the land prices will fall less, not more, when labor supply
is more elastic should be considered as a curiosum as it depends on a high
partial elasticity of substitution between labor and land relative to price
elasticity of demand for x . Also the model under consideration leaves
out the interaction between the demand of certain components of x (the
home goods sector in x) and income and population in x .

A narrowing of the possible range for dw/dT , and dr/dT depends
on estimation of the parameters expression I and II. However even without
hard estimates reasonable restrictions can be placed on the likely range
in the change in wages and land rents. For most cities the share of land
rents in the total value of output is unlikely to exceed 5%.[10] The share
of labor is around 70% and the share of capital 25%. The small share of land re-
lative to labor and capital means land rents may fall dramatically and still
not absorb the full burden of the tax on capital. The change in the price
of x is related to the tax and changes in factor price by the relation

$$dp_x = f_K dT + f_L dw + f_R dr \qquad (13)$$

Suppose that dT is 10%. For $f_K = .25$, the price of x will

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[10]The overall share of wages in national income is about 70%. This leaves
30% to be divided between real capital and land. The balance sheets in
statistics of Income Corporation Income Tax Returns (1966) show that for
all corporations the value of land relative to the value of depreciable
assets is about 13:1. For corporations in the real estate industry; an
industry in which large inventories of land are held for development pur-
poses, this ratio is about 3:1. From Netzer (1966) Table 2-7 we calculate
the ratio of residential structures to private residential land to be about
7:1. On the basis of these data it seems safe to conclude that average
capital rentals are at least five times the level of land rents.

increase by 2.5% when dw = dr = 0 . Even if dr/dT = 2 so land rents fall

by 20% and prices will increase by 1.5% the share of land in total costs

is only .05. When there is no possibility of substituting land for labor

or capital the value of dr/dT will exceed $f_K/f_R = 5$ for when $a_{LR} - a_{RR} = 0$

dw is positive so in order to remain fully employed land will have to absorb

not only the tax but also the increase in wage costs which result from the

substitution of labor for capital.

We have experimented with various values for E_x and E_y and the

production parameters and have found that even for low values of partial

elasticities of substitution of land for labor and land for capital the

value of dr/dT does not exceed 2. For example when $E_x = -1$, $E_L = 1$

and the partial elasticities envolving capital and labor are taken to be

1 while those involving land are assumed to be .1 the value of dw/dT = .02

and dr/dT = -1.5.

These numerical experiments suggest that when the demand for land

is unresponsive to   factor prices changes the wage rate will change

very little, especially for moderate responses in the supply of labor.

This will be true for a wide range of values for the partial elasticity

of substitution between labor and capital. For low elasticities of sub-

stitution between land and labor and land and capital, say in the range

.05 to .1, the price of land will fall substantially. For example, a 10%

tax on capital earnings may well decrease land rents by 20% of their original

value but because of the small share of land rents in total costs this de-

crease in the land rents will not offset the tax levy and prices will rise.

It is highly unlikely that land will bear more than 40% of the total tax

burden and quite likely that consumers will bear 75% more of the burden in the form of higher prices.

By treating land simply as another factor of production the fall in land rents will not, in the absence of a wage rate increase, exceed the level of tax collections. In an alternative characterization of the role of land in the production process where a fixed amount of land serves as a "base" for the building of indefinite height, the fall in land rents may exceed the taxes collected on improvements. To investigate this possibility we use a very simple model to determine the price and level of CBD activities. The demand for floor space at the CBD is a function of price, i.e. $x = f(p_x)$. The price is increased as a result of the tax offices and apartment houses move out of the central city. The marginal cost of a unit of floor space (building an additional floor) is assumed to rise and average costs, at any given level of output lie below marginal costs. If developers operating in the CBD take the price of output as given equilibrium will be reached when marginal variable cost is equal to price (average revenue). For simplicity we assume that only variable cost to be the cost of capital services. The difference between average revenue (price) and average cost multiplied by the level of output will be quasi rents that accrue to owners of land.[11]

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[11]A variant to this model is the case where all the ownership of land is very concentrated relative to its supply so that developers recognize the effect the size of their buildings will have on the price of floor space in this location and will set output at the level where marginal cost and marginal revenue (not average revenue) are equal. As long as there exists competitive bidding for the land all of the "monopoly profits" will accrue to land owners. For purposes of determining the effect of taxes on land rents the qualitative result for the "monopoly" model are essentially the same as for the competitive model.

The imposition of a property tax in a city shifts the marginal cost schedule upwards, increases the price of CBD services and leads to a decrease in output and land rents.

Total Revenue, $p_x x$, at the CBD is assumed to be equal to

$$ax + bx^2 \tag{14}$$

and total variable costs are equal to

$$(cx + mx^2)p_K \tag{15}$$

where p_K is the cost of capital.

The marginal cost of output which is equal to price is a function of the level of output and the cost of capital. For a change in p_K the change in the price of x to a first order approximation is equal to

$$\frac{dp_x}{p_x} = \frac{dp_K}{p_K} + e_s \frac{dx}{x} \tag{16}$$

where e_s is the elasticity of the marginal cost curve with respect to changes in output. Differentiating the demand relation we obtain

$$\frac{dx}{x} = E_x \frac{dp_x}{p_x} \tag{17}$$

From (16) and (17) it follows

$$\frac{dx}{x} = \frac{E_x \dfrac{dp_K}{p_K}}{1 - e_s E_x} \tag{18}$$

We assume that e_s is small relative to E_x . When $E_x = -1$ and $e_s = .1$ the fall in output will be 9% when capital cost are increased by 10%. When E_x is raised to -5, output will fall by 33% when the cost of capital is increased by 10%. For the linear model there is a very simple relation between rents and the change in output. Land rents are the difference between price (average revenue) and average cost multiplied by the level of output. As in equilibrium marginal cost is equal to price total land rents are equal to (marginal cost - average cost)X . This is equal to $(c + 2mx - (c + mx))x$ which reduces to

$$R(\text{land rents}) = mx^2 \tag{19}$$

m are of the two parameters of the total cost function is equal to $m(1+t)$ when capital is taxed at a rate t . The ratio of land rents with the tax to the level of land rents in the absence of tax is equal to

$$\frac{R_1}{R_0} = (1+t)\left(\frac{x_1}{x_0}\right)^2$$

Approximating the ratio of x_1/x_0 by means of equation (18) and taking t equal to .1 the ratio R_1/R_0 for $E_x = -5$ is equal to $(1.1)(.66)^2 = .48$. Land rents fall by more than 50% of their original value. For E_x equal to -1 the fall in land rents is about a little less than 10%, i.e. $R_1/R_0 = .91$.

The decrease in land rents relative to the level of tax collections on the improvements depends on the value of land relative to the value of improvements. Assume that before the tax was imposed   the ratio of capital

rentals was 4:1--and 100 units of capital were employed in the CBD. Capital is measured so that the after-tax return on capital is equal to 1. For $E_x = -.5$, the imposition of a 10% tax, the amount of capital is reduced to 66 units, tax collection is equal to 6.6 and land rents fall from 25 units to 12 units. For a ratio of improvements of 10:1 land rents would fall by 75% of tax collection.

For smaller values of the price elasticity of demand the fall in land rents will be much less dramatic. When E_x is equal to -1 tax collections will be equal to 9 units and land rents will fall by 9% of their original value when the capital to land ratio is 10:1. When the capital to land ratio is 4:1 the fall in land rents will be 25% of tax collections.

The simultaneous increase in prices and fall in land rents illustrates the need of dealing with both excise tax effects of local taxes and their effect on factor prices. In this model purchasers of the taxed commodities will pay prices that "include" the property tax and land prices may also fall by substantial amounts. There are two possible interpretations to the fall in land values. One is that it reflects a transfer of income from the owners of CBD land to the owners of suburban land where CBD activities have relocated. However if the CBD has some unique features that favor the concentration of economic activity at this site the imposition of the tax in the central city may lead to an overall fall in land values. The overall fall in land values reflects the dead weight loss associated with the dispersal of the CBD.

There are several reasons for doubting that land rents will fall by amounts which approach the level of tax collections on improvements. First

dramatic changes in rents depend on very elastic demand for floor space at the CBD. Second by ignoring complementary labor inputs in the provision of floor space at the CBD we exaggerate the increase in prices that result from an increase in the cost of capital. Finally it is unlikely that the value of land will be greater than 10% of the value of improvements.

5. The Differential Incidence of the Property Tax and Other Tax Systems

In analyzing the differential incidence of property taxes we shall concentrate on wage taxation and make two polar assumptions about the mobility of labor. If labor is perfectly immobile the basic effect of the substitution of wage taxes for property taxes by all communities is an increase in the average return on capital in the economy and a decrease in after-tax wages. The removal of the tax on the perfectly mobile factor, capital, will increase the prices of goods and services produced in communities which previously imposed relatively low rates of property tax. On the other hand prices in high-tax cities will fall. In general there will be a relocation of activities away from low tax towns to high tax areas; before-tax wages and land values will fall in the former and increase in the latter. After-tax wages will fall, of course, in all communities. Whether the tax substitution works to the advantage or disadvantage of residents of a particular town will depend on the source of income of the residents and the relative rate of property tax which the town previously imposed. The residents of cities which imposed relatively low rate of property tax, and is composed solely of workers, will suffer a loss in real income through a global introduction of wage taxes. The residents of high

tax areas composed primarily of capitalists will experience an increase in real income.

Results for mixed situations where towns consist primarily of workers and previously imposed high rates of property tax will be less clear cut. But it is possible that residents will be better off under property tax than under a wage tax of equal yield. The incidence of a wage tax is on labor and this burden will fall on residents and on commuters who work in the city but reside elsewhere. The burden of a property tax is shared by residents who consume home goods, landowners, workers and the consumers of commodities which are exported. When land is owned by residents the differential burden of a wage tax versus a salary tax on residents will depend on the wage tax which is borne by commuters and the proportion of the property tax shifted to non-residents in the form of higher industrial prices.

The substitution of wage taxes for property taxes will change the distribution income among residents. For the property tax system consumers of home goods and owners of land will bear a relatively greater tax burden, and they gain relative to workers if a wage tax is imposed. Although a close correspondence may exist between consumption and wage income it is not exact. Consequently a community may face a trade off between regressiveness and the minimization of tax burdens on residents.

A flat-rate production tax on all activities such as valued-added tax or a gross value-added tax is equivalent to a wage tax and a tax on profits imposed at the same rate. When labor is imperfectly immobile the burden of a 5% value-added tax on labor will be at least 5% of an original wage bill.

A local sales tax imposed on consumption goods and newly-installed capital goods is not equivalent to a production tax. A sales tax falls on imports exempts exports. A production tax raises the price of export goods and increases the real income of residents at the expense of non-residents.

The distributive effects of a local sales tax, new construction and newly installed capital equipment are similar to those of a property tax or a profits tax. However the government collects a smaller rate of tax and there will be a redistribution of income from purchasers of the services of capital to the owners of the existing (older) capital stock. Consider a tax on newly constructed dwelling units. The replacement cost of capital is increased and the price of new dwelling units will increase. If older dwelling units are close, even perfect, substituting the rents on older units will rise by amounts that approach the rent increases on new dwellings. The effect of such a tax on consumers is equivalent to general profits or property tax--but the government receives only a small part of the "tax revenues."

There is no fundamental difference between the analysis of the incidence of wage taxes when labor is perfectly mobile and the analysis of taxes on capital when capital is perfectly mobile. For the nation as a whole wages in the aggregate will fall by the average rate of tax on wages. As in the case of a property tax different cities will impose varying rates of tax. Labor will shift from high-tax cities to low-tax areas until after-tax wage rates are equalized. The general tendencies in changes in relative prices, level of economic activities, and land rents will be the same as for the

property tax. However the implications of a wholesale replacement of a property tax system for a system of differential set of wage taxes restricted so that tax yields are the same under both tax systems will have very dif= ferent implications for specific cities. The capital to labor ratios varies between cities so a city with a relatively high tax rate under a property tax system may be able to impose a relatively low wage tax. Consequently the adjustments in land prices, commodities prices, and for a specific city that take place under a wage tax system not only will not be of the same magnitude as for a property tax system but may even be of different sign.

At the city level a wage tax will have a different effect on relative commodity prices. The production of different commodities use varying amounts of labor and capital. As housing is relatively capital intensive the cost of housing services will be relatively higher for a property tax than for a wage tax of equal yields even though the replacement cost of housing will be increased by the wage tax.

When labor is perfectly mobile wage taxes will tend to depress land values in cities that impose relatively higher rates of tax.

Whether land rents will fall more under a wage tax than under a property tax depends on the relative responses in the demand for land for change in wages and for the cost of capital. A property tax increases the cost of capital and decreases in land prices will be cushioned by the possibility of substituting land for capital. Another consideration is whether resi= dential real-estate use relatively more land per=unit of output . The property tax increases the cost of housing services relatively more than a wage tax of equal yield. Consequently other things being equal the land prices will fall more for the property tax.

6. <u>The Benefits of Public Expenditures and Incidence of the Property Tax</u>

On balance the introduction of the benefit side of the budget sig-
nificantly complicates any analysis of the budgetary policies of local govern-
ments. Variations in the mix of public expenditures will have a differential
effect on the welfare of different groups. High welfare payments will benefit
low income groups and lead to an increase in the demand for certain types
of housing, and will also lead to an integration of other groups. Higher
expenditures on fire protection may decrease fire insurance rates on indus-
trial property and largely offset the increases in the cost of capital re-
sulting from the higher property taxes which finance the additional protec-
tion. Also additional expenditures on education, recreation, and transpor-
tation facilities will increase the demand for housing and other services.
A general way of introducing public expenditure is writing the demand for
home goods x_H as a function of their price p_H and the level of public
expenditures g . An increase in the property tax rate by increasing the
cost of capital will increase the price of home goods. However, if the mar-
ginal utility of public goods is high consumers will be willing to pay the
additional cost and the overall effect of a budget expansion will be to
increase the demand for home goods. The demand for industrial goods,
largely external will fall as a result of the budget expansion unless the
public expenditure decreases production cost, to compensate for the tax in-
crease, and/or increase the supply of labor.

If town officials do their job well and chose the level and compo-
sition of public expenditures in accordance with the preferences of the
electorate and attempt to "maximize the value of the town" the results on

budget incidence may be simpler and more straightforward than the separate analysis of taxes. Demand for home goods will be less responsive to budget changes and so will the supply of labor and the cost of producing industrial goods.

The introduction of the benefit-side in no way alters our basic conclusion that the property tax system for the nation as a whole depresses the return on capital and changes the cost of capital to higher-tax communities and decreases the cost of capital to low-tax communities. However, it may be highly misleading in empirical work to classify cities into high-tax cities and low-tax cities and to make empirical judgments on the decrease or increase in land rents and wages on a city by city basis, solely on the basis of tax differentials. Endowments of capital per households vary between cities and do the relative amounts of income redistribution which occur in each jurisdiction. A consideration of the separate effects of taxes, independently of expenditures is meaningful only with reference to an alternative source of tax finance.

7. The Dynamic Incidence of the Property Tax

As our analysis has been based on the assumption of a fixed capital stock, the objection may be raised that tax-induces changes in the savings rate will upset the conclusion that a property tax is a tax on profits. While the intertemporal effects of the property tax may be significant and should not be ignored, dynamic effects are fully consistent with the view that the property tax is initially a tax on profits. The writers who have maintained that the property tax is shifted as an excise have not based

their arguments on long-run factors related to the supply of savings and the level of investment.

My basic aim has been to investigate the short-run effects of property tax and a careful discussion of dynamic effects are outside the scope of this paper. Nevertheless the following points should be noted. First there is considerable uncertainty on the effects of property tax on savings relative to other types of tax finance. The income effect may be important if the recipients of profit income have a higher marginal propensity to save than the recipients of wage income. The size of the substitution effect is also uncertain, although recent work by Wright (1969) indicates that estimates the interest rate elasticity of personal savings with respect to the rate of interest fall in the range of 0.18 to 0.27, and are larger than those usually assumed.

When savings are sensitive to the rate of return the profits tax acts as a wedge between the marginal rate of transformation and the marginal rate of substitution and distorts intertemporal consumption choice. A property tax is inefficient relative to a lump sum tax of equal yield, and depending on the sensitivity of work effort to real wages, may be inefficient relative to a wage tax.

The total wage bill in the long-run will be affected by the imposition of a property on all capital. For a neoclassical production function that in the absence of technological progress the proportional changes in the marginal production of capital and labor resulting from a change in the capital to labor ratio are given by the relation

$$\frac{dp_K}{p_K} = -\frac{f_L}{S}\left(\frac{dK}{K} - \frac{dL}{L}\right) \tag{15}$$

$$\frac{dp_L}{p_L} = \frac{f_K}{S}\left(\frac{dK}{K} - \frac{dL}{L}\right) \tag{15}$$

where p_K and p_L are the marginal products of capital and labor respectively, f_K and f_L are the original shares of capital and labor respectively and S is the elasticity of substitution between labor and capital.

The rate of growth of the labor force is taken to be exogenous so expressions (14) and (15) approximate the difference in factor prices along two balanced growth paths where dK/K is the difference in the amount of capital per worker along those two paths.

Consider a situation where a 20% profits tax (a 2% property tax with a before-tax rate of return of 10%) is imposed, and $f_L = S = .75$.

Suppose that as a result of this tax the amount of capital decreases by 5% in the long-run. When the rate of return is original by 10% this will increase the profit rate to 10.5% and the after-tax rate of return will fall from 10% to 8.4%. The decrease in the wage rate which results from a 5% decrease in the amount of capital is .25/.75 ○ 5% = 1.67%. For this example the wage rate and the total wage bill have fallen as a result of the tax but most of the tax burden falls on capital earnings.

Clearly the more sensitive are savings to the rate of return the larger will be the burden on labor. If the supply of capital is perfectly elastic an after-tax rate of return of 10%, a 20% profits tax will decrease the equilibrium capital stock by 25% and increase the before-tax return

on capital to 12.5%. The wage rate in the new long-run equilibrium will fall by 8 1/3% and the decrease in the total wage bill is approximately equal to the level of tax receipts.

Furthermore, if the before-tax return on capital increases relative to the wage rate the price of capital-intensive commodities will increase relative to the price of labor-intensive goods. If specific income groups spend a disproportionate proportion of their income on capital intensive goods it will be necessary to account for changes in relative prices. For example, if the before-tax rate of return on capital increases by 25% and the wage rate falls by 8 1/3% as a result of the imposition of a property tax the change in the price of housing, dp_H, will equal $f_K dp_K + f_L dp_L$, which f_K and f_L are the shares of capital and labor respectively in the production of housing and dp_K, and dp_L are the changes in the cost of capital and labor respectively. If $f_L = 0$, the price of housing will increase by 25% relative to the commodities for which the contribution of capital to cost is equal to the average for all commodities.

8. Concluding Remarks

The principal conclusion of this paper is that the system of property taxes imposed by local governments decreases the overall return to capital by the average rate of tax in the nation as a whole, and changes the supply price of capital to different cities according to relationship of the specific rates relative to the mean rate of property tax. Cities with relatively high tax rate will pay for the services of capital, low tax rates result in a lower cost of capital.

Changes in the cost of capital lead to a reallocation of residential and industrial activities which in turn influence site values and the returns to other imperfectly mobile factors of production. The analysis of this paper suggests that changes in wage rates will be small in magnitude as labor is partially mobile and labor can be substituted for capital. Changes in land values are likely to be substantial but because of the low share of land rents in total costs are quite unlikely to approach increase sufficiently to offset the tax. Commodity prices will rise and I venture to guess that at least 75% of the burden of the tax differential falls on consumers, when capital is perfectly shiftable. In cities where the level of new construction is negligible tax changes will lead to a downward re-evaluation of the existing capital stock.

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