Land Value Taxation and Housing Development:

Effects of the Property Tax Reform in Three Types of Cities

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ABSTRACT. The effects of *land value taxation* on *housing* development are studied in three disparate *cities:* Pittsburgh, McKeesport, and New Castle, Pennsylvania. These places are examples of three different types of city: *central city, suburban city,* and *relatively isolated city,* respectively. Shifting *taxes* from buildings to land is hypothesized to have different effects in the different types of cities. A *liquidity effect,* due to increases in the *land tax rate,* is expected to operate in all three types of cities. An *incentive effect,* due to decreases in the *tax rate on improvements,* is expected to function in central cities and, possibly, in relatively isolated cities. It is not expected to be important in suburban cities such as McKeesport. An incentive effect was found in Pittsburgh, but not in the other two cities. No evidence of a liquidity effect was found in any of the three cities. An explanation of why observed effects may not conform with hypotheses is given.

I

Introduction

THE WORK REPORTED in this article extends the author's previous research on land value taxation[1] and housing development in Pittsburgh (Bourassa 1987) by applying the same methods used in that analysis to the study of McKeesport, and New Castle, Pennsylvania. This article also reviews theoretical and empirical research which suggest hypotheses addressing the disparate circumstances of central cities such as Pittsburgh, suburban cities such as McKeesport, and relatively isolated cities such as New Castle.

The method of study specifies a general econometric model of the housing market, adjusts the model to fit the circumstances of each city, and then estimates the adjusted models using time-series data for each city. The periods of study for each city cover spans of time during which there were both increases in the tax rates applicable to land, and decreases in the tax rates applicable to improvements. *Liquidity effects* of increases in the tax rate on land are expected

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to encourage housing development in the three cities. *Incentive effects* of decreases in the tax rate on buildings are expected to encourage housing development in Pittsburgh and, possibly, New Castle, but not in McKeesport.

II

Review of Economic Theory

ECONOMIC THEORY suggests that shifting the tax burden from improvements to land will encourage development in two ways. These are the liquidity and incentive effects. The liquidity effect results from increasing the land tax rate, while the incentive effect results from decreasing the improvement tax rate.

The liquidity effect has two components.[2] One component is the effect on current landowners, who must bear increased holding costs and who are thereby encouraged to improve their properties or sell them to someone who will. Bentick (1979) shows that land taxes affect the timing and type of development:

> Land taxes which are based on the current market value of land . . . divert land and saving from investment projects with a long gestation period to those which produce returns relatively quickly. This is because the market value of land reflects its future rentals, so that a tax on market value causes taxes to be levied ahead in time of the returns on which the tax is based, thus creating a liquidity problem which cannot be solved by a perfect capital market (p. 860).

The other component of the liquidity effect is simply the obverse of increased holding costs. This obverse component is due to capitalization of the tax. Capitalization of the land tax makes it easier for potential developers to acquire land and should thereby encourage development. As Becker (1969) observes:

> The benefit would be the equivalent of an automatic perpetual loan to the developer for purposes of land acquisition in the amount of the capitalized value of the land tax (p. 25).

The incentive effect of decreasing the tax rate on improvements is due simply to the reduction in the excise effects of the improvements tax. The tax on improvements is in part an excise tax which reduces the quantity of improvements produced.[3] Mieszkowski (1973) has argued that the system of local property taxes in the United States has both *global* and *excise* effects.[4] The global effect is a reduction in the real rate of return to capital by the average property tax rate. More important for my purposes is the excise effect, which depends on geographical variations in tax rates, with low tax communities having a lower cost of capital than high tax jurisdictions. Given the assumption of highly mobile capital, it is reasonable to expect that changes in tax rates will result in flows of capital from jurisdictions with high rates to those with low rates. With regard to housing, Mieszkowski observes:

> 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 (pp. 78–9).

Mieszkowski's analysis employs a number of simplifications, one of which is particularly worthy of mention with respect to the present study. His analysis for the most part ignores the fact that varying levels of public goods and services are provided in different communities with their differing tax bases and rates. As he notes:

> 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 (p. 75).

It is important to consider the effects of public expenditures because the obvious benefits of a reduction in the improvement tax rate could be offset to some degree by the adverse impact of a decrease in provision of public goods and services.

The effects of expenditures could be neglected if real revenues (and expenditures) remained constant while the tax burden was shifted from improvements to land. That hypothetical situation is unlikely, however, as municipal revenue needs tend to be increasing. In the case of Pittsburgh, for example, the improvement tax rate has remained relatively constant in recent years while the land tax rate has increased substantially. Presumably, real estate tax revenues have been increasing in Pittsburgh along with overall revenues and expenditures. While it would be easy to obtain relevant statistics, it would be patently difficult to reach any useful conclusions about changes in the levels of public goods and services provided in Pittsburgh and the effects of those changes on real estate investment in the city. Because the effects of changes in public expenditures are so difficult to account for and probably vary considerably over time and among places, it is prudent to conclude that the results presented here are likely to be rather time- and place-specific.

Another important consideration is the possibility of the migration of capital among various sectors due to differences in effective tax rates. Mieszkowski gives the following example:

> [C]apital 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 (p. 81).

Although different types of real property are assessed ostensibly at the same rates in Pittsburgh, McKeesport, and New Castle, hidden biases may exist. If so, reductions in the improvement tax rate would affect the various classes of property in a nonuniform manner and capital may migrate among the classes. It is also likely that different classes of land use would be affected in different ways by changes in land or improvement tax rates because some uses are land-intensive while others are capital-intensive. As in the case of public expenditures, geo-

graphical and temporal variations in assessment practices or land use characteristics make it difficult to generalize from results such as those presented here.

Elaborating on Tiebout's (1956) well-known hypothesis, Hamilton (1975b) concluded that property taxes in suburban jurisdictions act as benefit taxes rather than excise taxes. Tiebout posited that consumers' preferences for local public services are satisfied by migration among communities, given a fairly large number of communities providing varied sets of services. Hamilton observed that Tiebout's model failed to adequately address the matter of prices for local public services. As Hamilton (1975b: 205) notes: "the Tiebout Hypothesis seems to be a formula for musical suburbs, with the poor following the rich in a never-ending quest for a tax base."

Hamilton argues that property taxes act as the efficient prices for public services. In Hamilton's model, proportional property taxes are the only form of local revenue and zoning mandates a minimum level of housing consumption per family in each jurisdiction. Given a choice of jurisdictions with varying levels of public expenditures and zoning requirements, a household moves to the community that best satisfies its needs for housing and local public services. In this model, the property tax rate is proportional to the level of public services provided and is, in effect, the price of those services.

This mechanism does not, however, work in central cities because such cities are heterogeneous—*i.e.,* they cannot mandate city-wide minimum levels of housing consumption (Hamilton 1975a). Hamilton argues that:

> [T]he property tax in the central city does inhibit housing consumption in exactly the manner that an excise tax on any commodity inhibits its consumption. This leads to the prediction that the property tax will depress central-city residential property consumption relative to suburban consumption (p. 14).

Hamilton's analysis relies on a number of simplifying assumptions and it seems unlikely that the suburban property tax is a completely efficient benefits tax. Nevertheless, Hamilton (1975a) has provided some empirical evidence that clearly supports his theoretical conclusions. More recently, Ihlanfeldt (1984) has reported additional empirical results in support of Hamilton's thesis. Thus it seems that Hamilton's model may be a reasonably good approximation of reality.

To the extent that Hamilton's model is correct, one would not expect decreases in the improvement tax rate to have an incentive effect in suburban jurisdictions such as McKeesport.[5] In contrast, such an effect would be expected in a central city such as Pittsburgh. As for the case of New Castle, which is a relatively isolated city, one would expect the incentive effect to be less significant than in Pittsburgh, because it is more difficult for households to adjust their locations between urban areas than within an urban area.

III

The General Model and Adjustments

THE GENERAL MODEL of the urban housing market contains elements of both supply and demand. The logarithm of the demand function is:

$$\ln Q_d = a_0 + a_1 \ln R_n + a_2 \ln R_e + a_3 \ln Y + a_4 \ln N + a_5 \ln P_x \qquad [1]$$

where:

Q_d = quantity of housing demanded;
R_n = the average rent for new housing services;
R_e = the average rent for existing housing services;
Y = average household income;
N = the number of households;
P_x = the prices of other goods and services; and
$a_0, \ldots, a_5$ are the parameters of the equation.

The logarithm of the supply function is:

$$\ln Q_s = a_6 + a_7 \ln R_n + a_8 \ln P_0 + a_9 \ln P_m + a_{10} \ln r + a_{11} \ln t + a_{12} \ln z \qquad [2]$$

where:
Q_s = quantity of housing supplied;
R_n = the average rent for new housing services;
P_o = the prices of operating inputs;
P_m = the price of maintenance inputs;
r = the cost of housing capital;
t = the effective land tax rate;
z = the effective improvement tax rate; and
$a_6, \ldots, a_{12}$ are the parameters of the equation.

The relevant reduced-form equation is:

$$\ln Q = b_0 + b_1 \ln R_e + b_2 \ln Y + b_3 \ln N + b_4 \ln P_x + b_5 \ln P_0 + b_6 \ln P_m + b_7 \ln r + b_8 \ln t + b_9 \ln z \qquad [3]$$

where: $Q = Q_d = Q_s$; the variables are defined as before; and $b_0, \ldots, b_9$ are the parameters.[6]

The available data and the peculiar circumstances of each city necessitated adjustments to the basic model. In the case of Pittsburgh, the building permit data used for the dependent variable contain dollar values for housing construction in new buildings but exclude dollar values for housing rehabilitation projects. This made it necessary to add a variable to capture the effects of tax in-

centives affecting the flow of capital into housing in new relative to existing buildings. In addition, extensive mortgage subsidy programs in Pittsburgh suggested a need to divide the cost of capital variable into two components—one based on mortgage interest rates and the other based on the dollar amount of mortgage subsidies.[7] In all three cities, resident employment data were used as a convenient proxy for the combined effects of average household income and number of households.

IV

The Data

THE PERIODS OF STUDY were 1978–1984 for Pittsburgh, 1978–1986 for McKeesport, and 1979–1986 for New Castle. In view of the small number of years in each study period and the relatively large number of parameters to be estimated, monthly data were used. The data for the Pittsburgh study are described in Bourassa (1987); the discussion which follows deals with only the McKeesport and New Castle data.

As in the case of Pittsburgh, the dollar value of residential building permit applications was used as a proxy for the dependent variables in the McKeesport and New Castle studies.[8] In some cases, it was difficult to determine whether a given permit was issued for residential or for other types of construction; this ambiguity in the data may have affected the results somewhat.

Several price and cost indexes for the Pittsburgh area were used as proxies for variables in the McKeesport and New Castle models. Although McKeesport and New Castle are both near Pittsburgh (the former is a suburb, while the latter is outside the metropolitan boundaries), it is a rather bold assumption to suggest that indexes for the larger area are applicable to small communities in or near that area. In lieu of better data, however, it is hoped that the Pittsburgh indexes generally reflect trends occurring in the smaller communities. The proxy for average rent for existing housing services is the consumer price index for shelter costs, lagged one month to make it exogenous.[9] The proxy for the prices of other goods and services is the consumer price index for all items except shelter. The proxy for the price of operating inputs is the consumer price index for home heating fuels and other utilities. Finally, the proxy for the price of maintenance inputs is an index of residential construction costs.

As already mentioned, resident employment statistics are used as a proxy for the combined effects of household income and number of households.[10] These data include the number of workers residing in each city regardless of place of work.

The proxy for the cost of housing capital is taken to be the difference between the nominal home mortgage interest rate and an appropriate risk-free rate, in this case the nominal three-year Treasury Bill rate.[11] Since the difference between the nominal rates is the same as the difference between the real rates, there is no need to adjust for inflation.

The tax rates for McKeesport and New Castle are shown in Tables 1 and 2, respectively. In both instances, it was necessary to take into account county and school district rates as well as city rates. Unlike the cities, the counties and school districts do not have land value tax systems. It was also necessary to take into account changes and differences in assessment ratios[12] and tax abatements for improvements which went into effect in 1979 in McKeesport and 1982 in New Castle.[13]

V

Results

THE RESULTS for Pittsburgh indicated a significant incentive effect, but no liquidity effect. In other words, the improvement tax rate was a significant determinant

Table 1
REAL ESTATE TAX RATES APPLICABLE TO RESIDENTIAL DEVELOPMENT IN MCKEESPORT, 1978-1986[a]

	City			School	Total	
Year	Land	Structures[b]	County	District	Land	Structures
1978	24.5	24.5	21.375	41	86.875	86.875
1979	24.5	18.407	19.365	38	81.865	75.772
1980	90	15.026	23	46	159	84.026
1981	90	15.026	28	61	179	104.026
1982	90	15.026	29	69.5	188.5	113.526
1983	90	15.026	29	71.5	190.5	115.526
1984	90	17.28	29	71.5	190.5	117.78
1985	100	18.783	29	73.5	202.5	121.283
1986	100	18.783	31.25	73.5	204.75	123.533

Notes:
a. Figures are in mills. Except as noted for City structures, rates are nominal.
b. City structure rate is adjusted for the effect of tax abatements, which became available in 1979.

Sources: City Treasurer's Office, City of McKeesport; Deed Registry and Records Management Office, County of Allegheny; and Business Office, McKeesport Area School District.

Table 2
REAL ESTATE TAX RATES APPLICABLE TO RESIDENTIAL DEVELOPMENT IN NEW CASTLE, 1979-1986[a]

Year	City Land	City Structures[b]	County	School District	Total Land	Total Structures
1979	20.56	20.56	5.4	28.5	54.46	54.46
1980	22.08	22.08	6.0	29.7	57.78	57.78
1981	25.06	25.06	8.1	32.7	65.86	65.86
1982	40	17.13	7.5	33.9	81.4	58.53
1983	40	17.13	4.8	33.9	78.7	55.83
1984	48	19.384	6.3	33.9	88.2	59.584
1985	67.8	15.778	7.2	39.9	114.9	62.878
1986	67.8	16.116	9.6	42.3	119.7	68.016

Notes:
a. Figures are in mills. Rates are adjusted for differences in assessment ratios across jurisdictions and changes in ratios over time.
b. City structure rate is adjusted for the effect of tax abatements, which became available in 1982.

Sources: City Treasurer's Office, City of New Castle; County Treasurer's Office, County of Lawrence; and Business Office, New Castle School District.

of the amount of new housing construction but the land tax rate was not.[14] The elasticity estimate for the improvement tax rate was −2.36, implying that a one percent decrease in the nominal tax rate (adjusted for the effects of abatements) would result in a 2.36 percent increase in the dollar value of new housing construction.[15]

The empirical results for McKeesport are as follows:[16]

$$\ln Q = \underset{(1.11)}{-0.02} \underset{(0.30)}{-0.17} \ln R_e + \underset{(1.20)}{0.39} \ln M + \underset{(2.28)}{2.44} \ln P_x$$

$$\underset{(0.31)}{-0.25} \ln P_0 - \underset{(2.80)}{2.17} \ln P_m + \underset{(0.05)}{0.001} \ln r$$

$$\underset{(0.30)}{+0.03} \ln t + \underset{(0.21)}{0.05} \ln z$$

where M is the resident employment variable and the other variables are defined as before. The absolute values of the *t* statistics are given in parentheses. Only the coefficients for the prices of other goods and services and the price of maintenance inputs are significantly different from zero at the usual levels of significance. Both coefficients have the expected signs.[17] Neither of the tax rate coefficients is significantly different from zero.

Similar results were obtained for New Castle:

$$\ln Q = \underset{(4.46)}{-\ 0.05} + \underset{(0.14)}{0.02}\ \ln R_e + \underset{(0.25)}{0.06}\ \ln M + \underset{(2.95)}{2.30}\ \ln P_x$$

$$- \underset{(0.41)}{0.28}\ \ln P_0 - \underset{(0.72)}{0.52}\ \ln P_m - \underset{(1.15)}{0.01}\ \ln r$$

$$- \underset{(0.25)}{0.03}\ \ln t + \underset{(0.53)}{0.10}\ \ln z$$

where, as before, the parentheses contain the absolute values of the *t* statistics. In this case only the coefficient for the prices of other goods and services is significantly different from zero at the usual levels (it also has the expected sign). Again, neither of the tax rate coefficients is significantly different from zero. Both estimations yielded high coefficients of determination—0.98 for McKeesport and 0.99 for New Castle. This fact, coupled with the low *t* statistics for most of the variables, suggests that there is a problem with multicollinearity in the data for both cities. In other words, the estimation procedure is unable to determine which independent variables are actually having an influence on the dependent variable in each case. This is a rather intractable problem[18] which at best has the advantage of ensuring conservative conclusions.

In part, the results confirm theoretical expectations. The tax on improvements has a significant excise effect in Pittsburgh, a central city, but no detectable effect in McKeesport, a suburban city. Contrary to expectation, the tax on land did not have a significant effect in any of the three cities. Also, the tax on improvements did not have a discernibly significant effect in New Castle. That result *is* consistent with the idea that the incentive effect would be less significant in a relatively isolated city than in a central city.

VI

Conclusions

GIVEN THE RESULTS of this study, land value taxation seems to be a desirable strategy for central cities to employ in seeking to encourage development and attract households. Because households are relatively mobile within metropolitan areas, land value taxation may permit central cities to attract households that would otherwise locate in nearby suburban jurisdictions.

The results of this study should not be taken to imply that land value taxation is not or could not be a useful tool for cities such as McKeesport or New Castle.[19] As was already mentioned, land value taxation may have different effects on different classes of property, and it is possible that studies of commercial or

industrial properties in those places would yield positive results. Also, the various data problems—particularly the problem of multicollinearity—may have led to excessively conservative conclusions with respect to residential development. In addition, it is possible that changes in public expenditures offset the tax rate changes and skewed the results.

Finally, as is true for the incentive effect, the liquidity effect may be significant for some classes of property but not for others or in some places and times but not others. This suggests that it may not be valid to generalize from the results presented here. The results are, however, consistent with Pollakowski's (1982) results, which implied that the liquidity effect would be minor.

Notes

1. *Land value taxation* generally refers to the taxation of land at rates higher than those applied to buildings and other improvements.

2. This discussion of the liquidity effect is taken from Bourassa (1987).

3. Note that land is in fixed supply and that, therefore, increases in the land tax cannot affect the quantity supplied. See Netzer (1966: 33) for further discussion of this point.

4. Mieszkowski uses the term *property tax* to refer to taxes on reproducible capital; he does not consider the effects of taxes on land.

5. To the extent that zoning in suburban jurisdictions has placed an effective limit on the intensity of land use, one would not expect a liquidity effect to result from increases in the land tax rate. This does not seem to be the case in McKeesport, however (it would not make much sense to try to encourage development with a land value tax while simultaneously preventing development with a restrictive zoning ordinance).

6. For discussion of the assumptions implied by this model, see Bourassa (1987).

7. Also, a dummy variable was used to capture the effect of an anomalous project that was distorting the Pittsburgh data.

8. Unlike the Pittsburgh data, the McKeesport and New Castle data include values for rehabilitation projects. Public housing projects, which would not be affected by tax rates, were deleted from the data. The building permit series were smoothed using a twelve-month centered moving average in order to eliminate seasonal and irregular fluctuations. The data were obtained from the building inspector in each city.

9. Otherwise, R_e would be a function of Q. All of the consumer price indexes are from the *CPI Detailed Report,* published by the Bureau of Labor Statistics, U.S. Department of Labor. The construction cost index was derived from Boeckh's *Building Cost Index Numbers,* obtained courtesy of American Appraisal Associates, Milwaukee, Wisconsin.

10. These were obtained from the Office of Employment Security, Department of Labor and Industry, Commonwealth of Pennsylvania.

11. Data for the Pittsburgh metropolitan area were obtained from the Federal Home Loan Bank Board. In this case, data for the Pittsburgh area are clearly applicable to McKeesport and New Castle, because most banks in the smaller cities are branches of Pittsburgh banks. The interest rate proxy in this model differs from that used in the Pittsburgh study (see Bourassa 1987). Estimating the Pittsburgh model with the revised proxy did not yield any significant change in results.

12. Because assessment ratios did not, *in effect,* change in Pittsburgh and McKeesport, nominal tax rates (adjusted for the effects of abatements) were used for those studies.

13. The computation for taking into account abatements is described in Bourassa (1987).

14. For a more detailed presentation of the Pittsburgh results, see Bourassa (1987).

15. The Pittsburgh results also showed that decreasing the improvement tax rate has encouraged housing development in Pittsburgh by encouraging the construction of additional units rather than by encouraging increases in the average cost of new units. This fact is consistent with Mieszkowski's suggestion that changes in property tax rates will lead to shifts in the location of households.

16. As in the case of Pittsburgh, initial estimation of the models for McKeesport and New Castle indicated a problem with autocorrelation. This problem was handled with the first difference method, using the Durbin-Watson *d* statistic to calculate the coefficient of autocorrelation.

17. For a discussion of expected signs, see Bourassa (1987).

18. The commonly-cited solution of removing independent variables is unsatisfactory because it may result in specification error. As Gujarati (1978: 186) notes: "the remedy may be worse than the disease in some situations because while multicollinearity may prevent effective estimation of the parameters of the model, omitting a variable may seriously mislead us as to the true values of the parameters."

19. It should also be noted that land value taxation may be desirable purely on equity grounds. See, for example, the argument put forth by George (1954: 333–46).

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