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THE IMPACT OF URBAN LAND TAXATION: THE PITTSBURGH EXPERIENCE

October, 1992

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Working Paper No. 47

This publication was made possible through support provided by the U.S. Agency for International Development, under Cooperative Agreement No. DHR-0015-A-00-0031-00.

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Preliminary Draft

The Impact of Urban Land Taxation:

The Pittsburgh Experience

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Land value taxation occupies a curious place in the lexicon of public finance. It has a long and rich history both among tax theorists and among reformers who have extolled its properties on grounds of economic efficiency and equity. And it still commands a certain respect and interest on the part of both scholars and practitioners. Yet it has not been widely used, and public-finance economists do not have a good sense of its real potential as an effective form of taxation. Even so, it is under serious consideration as a revenue instrument both among hard-pressed city mayors and, more surprisingly perhaps, among emerging governments in transition from socialism to market-oriented economies.

There is, in the United States, a single case of major reliance on land taxation in a large city: the city of Pittsburgh in 1979 and 1980 restructured its property tax system to one in which land is taxed at more than five times the rate as the structures on the land. With the passing of over a decade, we are now in a position to explore the effects that this tax reform has had on economic activity in the city and metropolitan area.

To assess this experience, it is essential to have a clear understanding of the theory of land value taxation. There has, in fact, been some recent theoretical work which raises the possibility that land value taxation need not be neutral in its effects, as the standard theory maintains. In the next section of the paper, we will review the theory of land taxation to provide the conceptual context for our study of the Pittsburgh experience.

In the succeeding sections, we turn to a description and analysis of the Pittsburgh experiment with land value taxation. The findings, taken at face value, are dramatic. Relative to fourteen other midwest cities in our sample, Pittsburgh is a striking outlier: it is the only city to have experienced a large and significant increase in levels of building activity during the 1980s. The interpretation of these basic findings is, however, complicated. There were other things, including a major urban renewal program, underway during this same period. And it is hard to separate the effects of tax reform from other economic events. But the alternative is simply to ignore this interesting episode in fiscal history--and this, it seems to us, would be a mistake.

To address the impact of land value taxation in Pittsburgh, we have undertaken a careful study of the history of the Pittsburgh economy and the specific character of the tax reform. These, we will argue, are critical to a proper interpretation of the Pittsburgh experience. To carry out the quantitative analysis, we have assembled two independent bodies of data on levels of building activity in Pittsburgh and in a sample of other cities in the region. Each has its strengths and weaknesses. The first is a lengthy time series covering the period 1960 to 1989, whose source is Dun and Bradstreet figures on the value of new building permits. The attraction of this data is its coverage over time; it is, however, limited to the city itself and provides no disaggregation among different types of building activity. The second set of data, which we have pulled together from U.S. Bureau of the Census sources, provides coverage for the entire metropolitan area, broken down by city and suburbs, and also disaggregated by type of building activity. Its coverage over time is, however, more limited: 1974 to 1989. Although the two data bases exhibit, in certain instances, some puzzling differences, they yield much the same picture of the Pittsburgh experience relative to the other cities in the region.

The analysis of these data, in the context of some other key economic variables, suggests to us that the Pittsburgh tax reform, properly understood, has probably played a significant supportive role in the economic resurgence of the city. We shall work through a number of pieces of evidence that lead us to this conclusion.

1. The Theory of Land Taxation

Proponents of land value taxation have cited a number of its appealing properties, one of which is its neutrality with respect to land use. As Dick Netzer (1966) put it, "Location rents constitute a surplus, and taxing them will not reduce the supply of sites offered; instead, the site value tax will be entirely neutral with regard to landowners' decisions, since no possible response to the tax can improve the situation, assuming that landowners have been making maximum use of their sites prior to the imposition of the tax" (pp. 204-5).

Conventional property taxation, in contrast, involves the taxation of both land and improvements to the land; such taxes, as has long been recognized, are clearly not neutral as they place a levy on any structures on the land. A shift from property to land taxation (or the movement to a "graded" tax system under which land is taxed at a higher rate than the structures on the land) will reduce the "penalty" on improvements and encourage more intensive land use. Jan Brueckner (1986) has demonstrated this proposition in a rigorous static analysis: the replacement of taxes on structures by levies on land value will result in a higher level of improvements to the land (i.e., a higher capital-land ratio). We will refer to this as the capital-intensity effect.[1]

In an intertemporal setting, land value taxation can have a different sort of effect (apart from any tax on structures). In two interesting papers, Brian Bentick (1979) and David Mills

[1]For some sense of the magnitude of this effect, see the computable general-equilibrium analyses in the papers by Joseph DiMasi (1985) and by James Follain and Tamar Emi Miyake (1986).

(1981) have shown that land value taxation need not be neutral with respect to the timing and nature of land development. In particular, the taxing of land values <u>may</u> distort the choice between earlier and later development of unused land parcels in favor of those projects that promise an earlier stream of net receipts. The implication of their models is that a movement in the direction of land taxation may hasten economic development, perhaps to an extent that is excessive on purely efficiency grounds. This effect, however, depends upon an important and controversial assumption concerning the way in which land is valued for tax purposes. Where this assumption is satisfied, land-value taxation can have what we will call a <u>timing effect</u>.[2]

In Appendix A, we present a formal intertemporal model that embodies both the capital-intensity and timing effects. In this model, vacant land exists which can be committed in the current period to one activity or held idle to be devoted to another activity in the following period at a higher rate of return. We find in this simple model, first, that higher taxes on structures depress the structure-land ratio (the capital-intensity effect). And second, we find that where certain procedures are followed for determining the taxable value of land, a Bentick-Mills timing effect exists.

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[2]The literature has noted another potential source of a timing effect. Since land-value taxation requires the paying of taxes in advance of any income from land to be developed in the future, there can exist, in circumstances of constrained access to credit markets, a "liquidity effect" that induces premature development of unused land parcels.

For purposes of exposition here, we will simply work through an illustrative case of land taxation. Since the capital-intensity effect is well understood, we shall focus our attention in this example on the timing effect.

We present in Table 1 a simple numerical example. The initial conditions describe an equilibrium in land-use decisions in the absence of any taxation. Each landowner is indifferent between (1) development at the current time (use A) with a stream of rental income in perpetuity of $1,000 per period, or (2) waiting one period and employing use B to receive a rent per period of $1,100. The present values of these two alternatives are both $10,000 at the assumed rate of interest of 10 percent.

In section 3 of the table, we introduce a tax on land rents of 20 percent. The effect of this tax is simply to reduce the net rents on each use, and hence the present value of land in each use, by 20 percent. The tax clearly has no allocative effects on land-use decisions. A tax on land rents is thus a neutral tax: its sole effect is to reduce the value of land holdings.[3]

In contrast, we find in section 4 of the table that a Bentick-Mills tax on land values of 2 percent alters the relative value of land uses A and B. It depresses the present value of use B relative to that of use A, and hence will encourage a flow

[3]This admittedly abstracts from whatever effects the tax revenues have on government spending or, alternatively, on revenues from other tax sources. It also ignores possible changes in behavior by landowners (or others) from the associated income and portfolio effects (Feldstein 1977).

of land out of future use B and into current use A. The rationale for this result is clear from the arithmetic. Under land-value taxation, future rental income manifests itself in current land values with the result that future rents are effectively taxed in advance of their receipt. As Bentick (1979) and Mills (1981) show, this is equivalent to raising the rate of discount by the amount of the tax rate on land. It imposes, in a sense, a tax on waiting so that the return from delaying development must be higher in the presence of land value taxation than in its absence if such delay is to be profitable. The return from waiting must compensate landowners <u>both</u> for the opportunity cost of the funds tied up in the land and the taxes paid on the vacant parcel. Moreover, as Bentick and Mills show with some illustrative calculations, this timing effect could be sizeable in magnitude.

Returning to our example, we see in line 3 of section 4 that the relative value of the two uses would not be altered if land being held for use B was not taxed during the period it is vacant. The source of the non-neutrality under this version of land value taxation is the taxation of land <u>during the period when it is being held idle</u>. Were taxation to commence when the land is developed, the tax would effectively become a levy on land rents and would indeed be neutral and non-distortionary. We thus see that taxation of land <u>values</u> can effectively penalize land parcels held idle for purposes of development in the future and thereby lead to socially excessive levels of current development.[4]

There is an important and compelling line of objection to the non-neutrality result that we have presented above. As David Wildasin (1982) and T. Nicolaus Tideman (1982) have pointed out, this result depends on a particular form of assessment practice. Returning to our illustration in Table 1, the non-neutrality of land value taxation results from the practice of taxing land on the value associated with its chosen use. If land were always assessed at (each point in time) for tax purposes on the basis of its "highest and best" possible use, irrespective of any commitments to a particular use, then land-value taxation would indeed be neutral. Taxation at such a standard value (Vickrey [1970]) would be use-independent and, hence, neutral. In terms of our example in Table 1, all parcels (irrespective of their use) would be taxed as if they produced a rental income of $1,000 in period one and $1,100 in all subsequent periods.

This issue is a tricky one. Suppose that land use decisions involve if not permanent, at least very lengthy, commitments to a specific form of usage. As Bentick (1982) argues, if we treat uses of land as (effectively) mutually exclusive, then the value of land at a particular time will depend upon the use to which it has been committed (See also Bentick and Pogue [1989]). Much clearly depends here on existing assessment practices: to the

[4]Wildasin (1982) points up another potential source of intertemporal non-neutrality: changes in the tax rate on land over time. For example, increasing tax rates over time would tend to penalize projects whose returns are more concentrated in the distant future.

extent that the assessed value of parcels reflects decisions as to its use, the timing effect becomes potentially important. This suggests that any study of the actual effects of land taxation must pay careful attention to existing assessment procedures.

2. Pittsburgh: The Setting and Fiscal Reform[5]

In order to understand the effects of land value taxation in Pittsburgh, it is important to place this tax reform in the context of the ongoing economic evolution of the city and metropolitan area. Pittsburgh has been undergoing a very basic and far reaching process of economic transition. The economic core of the city in the late nineteenth and early twentieth centuries was its manufacturing base with a heavy concentration of steel mills. In recent decades, however, the Pittsburgh economy has shifted away from this heavy reliance on manufacturing toward a more white-collar oriented economic structure based on light manufacturing and services. In 1940, manufacturing employment in the four-county Pittsburgh MSA accounted for almost half of the total work force; in 1981, manufacturing employment constituted less than one-quarter of total employment. And by 1985 manufacturing employment was down to only 16 percent of total employment.

Like most other major U.S. cities, Pittsburgh has exhibited

[5]For a useful description of the historical evolution of Pittsburgh with a focus on the renewal efforts under Renaissance I and II, see Shelby Stewman and Joel Tarr (1982).

a loss of population: the city's population fell from a high of over 700,000 in 1950 to about 400,000 in 1980. This reflected largely a process of suburbanization with the total population of the metropolitan area remaining roughly the same. Pittsburgh grew in its early years by a process of annexation and consolidation. However, there has been virtually no further annexation or consolidation since World War II; suburban townships have retained their independence.

Pittsburgh has undergone a striking process of urban renewal. This began in the 1940's with Renaissance I, a major effort to clean up the environment of the city and to revitalize the central business district. Based on a series of projects involving a public-private partnership, Pittsburgh made major advances in cleaning up air quality, in flood control (which had been a real problem with periodic heavy flooding of the CBD), and in the construction of new office buildings in the Golden Triangle (CBD). It is interesting that these efforts received a major impetus from a severe shortage of office space; from 1945 through 1952 Pittsburgh's office occupancy rate was 99 percent. Under the rubric of an Urban Redevelopment Authority (URA), the city's political and business leaders launched a series of major construction projects that resulted in new office buildings, parks, and some luxury apartments. One fourth of Pittsburgh's downtown was rebuilt within ten years.

Following an "interlude" (and of central importance to this study), Pittsburgh launched a new renewal effort in the late

1970s: Renaissance II. As before, the renewal effort involved an extensive partnership between public and private agents with a major focus on continued development of the central business district. Interestingly, this effort also seems to have been encouraged by a severe shortage of office space: occupancy rates of city office space were again at the 99 percent level in 1980. Several major corporations decided to expand their headquarters in Pittsburgh and with public assistance constructed a series a major office complexes. The result was a striking surge in levels of commercial construction activity: there were commercial contract awards in 1980 for 9.5 million square feet of new space with (as we shall see) continued high levels of building activity through most of the decade.[6]

Pittsburgh, along with a handful of smaller cities in Pennsylvania, has had a graded property tax system in place for many decades, a system under which land was taxed at a rate twice that of the structures on the land until 1979. As Table 2 indicates, Pittsburgh introduced a striking restructuring of the city's property tax in 1979 and 1980, raising the tax rate on land to about five times the rate on structures. This increased "tilt" of rates has been maintained and even increased slightly

[6]The commercial building boom in Pittsburgh under Renaissance II has encompassed several major projects: PPG Place (six buildings, including a forty-story office tower), One Oxford Center (a forty-six story office tower and retail complex), The Steel Plaza/One Mellon Bank Center (a fifty-three story office tower and retail complex that includes the main station of the Light Rail Transit [LRT] system), Allegheny International's headquarters, Liberty Center, the Hillman Complex, and several others.

during the decade following the restructuring.[7]

Two aspects of this tax reform are particularly important. First, note in Table 2 that properties in the city of Pittsburgh are subject to taxation not only by the city government, but also by the county and the overlying school district. These latter two jurisdictions do not participate in the graded tax system: they employ a conventional property tax that applies the same tax rate to land and structures. As the last column of the table indicates, this results in total tax rates on land in the city of Pittsburgh that are something more than twice the rate on structures. Properties outside the city are, in contrast, subject to conventional property taxation.

Second, Table 2 suggests that the tax reform in 1979-80 involved raising the rate on land while holding constant the rate on structures. This is, however, misleading. What the table fails to reveal is that generous tax abatements were granted for new construction, both commercial and residential, in the city. Under these abatements, the city did not tax the additional value from new construction for the first three years (Weir and Peters, [1986], p. 75). The tax savings amounted to several million dollars. In addition, the Urban Redevelopment Authority (URA) offered low interest loans for commercial and residential rehabilitation and construction. Finally, it is worth noting that new federal programs, notably the Economic Recovery Tax Act

[7]The assessment-sales ratio in Pittsburgh is .25 so that the nominal tax rates appearing in Table 2 must be divided by 4 to obtain measures of effective tax rates.

of 1981, provided important incentives for the renovation of old structures by providing accelerated depreciation and tax credits.

Tax reform in Pittsburgh thus entailed raising the tax rate on land and effectively reducing the rate on improvements for new structures. We turn now to an examination of the effects of these measures on building activity in Pittsburgh.

3. An Analysis of the Pittsburgh Experience

Before turning to our work, we note that there have been three earlier studies of the effects of land value taxation in Pittsburgh. Henry Pollakowski (1982) was unable to find much in the way of "adjustment effects" as measured by the number of property transactions. However, his data extended only from 1976 through 1980. Steven Bourassa (1987) explored the effects of Pittsburgh's tax system on housing development. Using monthly data on the value of new residential building permits as his dependent variable, Bourassa found that the tax rate on improvements, but not the rate on land, was a statistically significant determinant of the level of residential building activity. Bourassa's findings, while of some interest, are limited in scope, for, as we shall see, the major impetus to development in Pittsburgh has been in the non-residential sector.

Of more relevance to our concerns is an interesting study undertaken in the mid-1980s by the Pennsylvania Economy League (1985). At the request of Mayor Richard Caliguiri, the League examined the effects of the graded tax on both the development of the city and the equity of the tax system. Drawing both on extensive interviews with "local development experts" and some quantitative analysis of the graded-tax ratio and development of different properties, the League concluded that "The graded tax has very little effect on development" (p. ii). We will draw on the League's report at various points in our discussion.[8]

We turn now to our study. To provide a baseline for comparative purposes, we have assembled time-series data on new building activity for a sample of 15 cities and metropolitan areas in the general region containing Pittsburgh (the socalled "Rust Belt"). We begin the analysis by simply presenting some summary data on the average annual value of new building permits both before and after 1979-80, the time of the new tax measures in Pittsburgh. As noted in the introduction, we have two independent sources of data.[9]

Table 3 presents figures for the <u>real</u> value of new building permits for the 15 cities in our sample. We have calculated these figures from data provided by Dun and Bradstreet; these data extend all the way back to 1960, but include only the center city and not the rest of the metropolitan area. The figures are quite striking: they reveal a typically quite substantial decline in the annual real level of building activity from the period 1960-79 to 1980-89. Only two or our 15 cities experienced

[8]For a valuable published presentation of the League's study, see Weir and Peters (1986).

[9]For a more detailed description of the sources and nature of our data, see Appendix B.

an increase. Columbus shows a slight rise. But Pittsburgh is a remarkable outlier: the real value of building permits on an annual basis rose by some 70 percent in the 1980s relative to the twenty-year period preceding the tax reform!

Table 4 provides some further analysis of the Dun and Bradstreet data. We have analyzed those data using a variety of econometric approaches including ARIMA "intervention models". The results from all of these approaches are very similar. Table 4 includes the results from the most straightforward approach, where we have regressed the log of the Dun and Bradstreet data on a constant and a dummy variable with a value of one for years 1980 and after and a value of zero for earlier years (Model 1), or alternatively, a constant, the dummy variable, and a time trend (Model 2). We find that these estimates confirm the message from Table 3. Of all the cities in our sample, only Pittsburgh in Model 1 exhibits a positive and statistically significant coefficient on the dummy variable. In Model 2 both Pittsburgh and Buffalo have significant dummy variables. Here we find that the coefficient on the time variable (Year) is negative for most cities and often statistically significant, suggesting a negative time trend over the whole period in levels of building activity in these cities. This is consistent with the general view of economic stagnation that is associated with cities in this region of the country. Interestingly, we find that this is true for Pittsburgh as well as many other cities in the sample. But for Pittsburgh the downward trend is offset by the powerful effect of the shift (dummy) variable that, we presume, captures the regime change in that city. Taken at face value, these results suggest that Pittsburgh was also on a downward course but that this course was displaced by events taking place at the end of the 1970s.

Table 5 provides summary results from another source of "before and after" data; these data are on a metropolitan area basis with disaggregation between center city and suburbs and between residential and nonresidential construction. We have compiled these figures from U.S. Bureau of the Census sources; in contrast to Dun and Bradstreet, they reach back only to 1974.[10] The Census data reveal a general picture of overall city building activity that is roughly consistent with that from Dun and Bradstreet. The real annual value of total building permits is lower after 1979 than before in most cities. But Pittsburgh again stands out with a dramatic increase of more than 250 percent. The disaggregation that the Census data makes possible provides some further valuable information. We find that the impetus to building activity in the Pittsburgh area was confined to the center city; the average annual value of building permits in the suburbs actually declined from the earlier to the latter period. In addition, the data indicate that the primary thrust to increased construction activity was in the nonresidential

[10]We note that there is more than one "central city" in the Allentown and Youngstown MSA's. The Census data encompass all those cities, but the Dun and Bradstreet figures include Allentown and Youngstown alone.

sector; residential improvements rose only modestly, while nonresidential construction more than tripled in annual value.

As with the Dun and Bradstreet data, we have subjected the Census data to some regression analysis. In Table 6, we report the results of re-estimating Models 1 and 2 from Table 4 using our Census data. We are now able to disaggregate the value of new building permits into residential, nonresidential, and office construction and to estimate separate equations for the center city and suburbs. We find in Table 6 that for the city of Pittsburgh the dummy variable is large and significant for nonresidential, and even more so, for new office construction. The effects in the Pittsburgh suburbs are much smaller and less consistently significant (although in one case, namely Model 1 for office construction) the dummy variable is positive and statistically significant).

The basic data thus suggest that as compared to other cities in the region, something quite dramatic happened to levels of building activity in Pittsburgh after 1979-80. Moreover, this appears to have been a center-city phenomenon that did not extend to the suburbs and one that was driven primarily by increased building activity in the non-residential sector.

This brings us to the question of the forces that induced this striking increase in city non-residential construction activity in the 1980s and, in particular, to the role played by the new tax measures. The tax changes could, in principle, have encouraged building activity in two ways. First, as we have discussed, the dramatic increase in the tax rate on land might have had a timing effect that would have induced earlier development of unused parcels than otherwise. And, second, the tax abatements on new structures are likewise a potential inducement to new construction.

The first of these effects, as we noted earlier, depends critically on the nature of assessment practices. The issue here is to determine whether or not we are in a Bentick-Mills world in which land value taxation has a timing effect or whether we are in the more traditional Tideman-Vickrey world in which land value taxation is neutral. As we have seen, the crucial condition is whether or not land assessments for purposes of taxation are dependent on the particular use of a parcel or whether they consistently reflect the highest and best use of a parcel irrespective of its current employment.

We have explored this issue with some care, including numerous discussions with the Director of Assessments for Allegheny County (of which Pittsburgh is part). And it turns out to be a complicated and quite tricky matter. For the major building projects in the CBD in the early 1980s, there were apparently available some "good" and recent sales of vacant land parcels which were used as a basis for the land assessments. But this really doesn't answer our question. The issue is whether at some later date if land values changed as a result of new "highest and best uses," the assessed land values would be adjusted accordingly. The assessor's answer to this question is, in principle, yes. Land assessments would, in principle, be adjusted to reflect changes in the values of existing vacant parcels. This would appear to suggest that Pittsburgh was operating in a Tideman-Vickrey setting and that there should be no timing effects.

However, things are not quite this clear-cut. In fact, the determination of assessed land values is more complex and pragmatic than the discussion to this point would suggest. It is, we have learned, quite typical for property assessments involving large parcels in the city to be appealed and subsequently litigated. And frequently this procedure produces reductions in the land assessments. The outcome is often a kind of "compromise" in which numerous criteria are brought to bear. Thus, it would not be at all surprising if through one channel or another, existing patterns of land use had some impact on land assessments. For this reason, Bentick-Mills types of timing effects cannot be ruled out categorically in the Pittsburgh case. But it our sense that such timing effects were probably not of much importance in development decisions. Some pieces of informal evidence support this conclusion. First, in their interviews with "development experts," the Pennsylvania League (1985) found no evidence that the increase in rates of land taxation exerted a noticeable impact on construction activity. "Most of those interviewed stated that property taxes played a very small part in any development decision and that the effects of the graded tax were negligible" (p. 20). And second, the

League found that several of the major projects that were begun in 1981 were well along in the planning stages before the increase in the graded-tax ratio.[11]

There are obviously things other than the fiscal system that influenced development decisions in Pittsburgh. And we turn to them now. As mentioned earlier, there was undertaken in the late 1970s a concerted renewal effort under the title of Renaissance II. Moreover, it is clearly important to look for elements in the general economic "climate" that might have favorably influenced economic activity. Of particular importance is the state of excess demand for structures. As a proxy for this variable, we present in Table 7 data that we have assembled for ten of our cities for selected years on vacancy rates in downtown office buildings. The figures for Pittsburgh are striking: they indicate that by 1980 the vacancy rate had fallen below one percent, suggesting the existence of considerable excess demand for new office space. The data indicate, moreover, that the construction of several massive new office buildings in the early 1980s effectively remedied the situation, as office vacancy rates rose sharply by the middle of the decade.

The excess demand for office space was undoubtedly an important contributor to the decisions to erect new office complexes in the CBD. However, the rest of Table 7 is of

[11]We recall also Bourassa's study (1987) of the residential sector in which he found in his regression equations that the land tax was an insignificant determinant of the level of residential building permits while the tax rate on improvements had a substantial and statistically significant effect.

interest in this respect. Several other cities in our sample likewise exhibit quite low downtown office vacancy rates. But they did not experience the building boom that characterized Pittsburgh in the 1980s.

To look at this a bit more closely, we have undertaken some regression analysis of the time-series data for Pittsburgh in which we allow both for the effects of the vacancy rate and the regime change. In equations (1) and (2), we report the results of re-estimating Models 1 and 2 using the Dun and Bradstreet data and including along with the dummy variable (D) for the tax regime (and the time variable (Y) in Model 2) the annual occupancy rate (R) for office buildings:

$$(1)\quad LDB = \underset{(1.79)}{6.69} + \underset{(3.90)}{0.597D} + \underset{(2.98)}{0.057R} \qquad R^2=.41 \qquad \text{Model 1}$$

$$(2)\quad LDB = \underset{(1.58)}{45.96} + \underset{(3.46)}{0.870D} - \underset{(1.35)}{0.020Y} + \underset{(2.43)}{0.048R} \qquad R^2=.45 \qquad \text{Model 2}$$

We find, first, that the estimated coefficient of the occupancy rate is positive and significant in both equations; a one percentage point increase in the occupancy rate raises real building permits by roughly 5 percent. Second, the post-1979 dummy variable remains positive and significant though slightly smaller than in Table 4. These results are thus consistent with the view that the shortage of office space, although an important determinant, is not the sole explanation of the building boom in Pittsburgh in the 1980s.

4. Conclusions

It is now time to try to draw together the various strands of evidence and assess the role that land value taxation has played in the resurgence of building activity in the 1980s in the city of Pittsburgh. There are obviously serious limitations inherent in any exercise that involves the analysis of a single case of any phenomenon. And we are acutely aware that not only do we have a single case of land value taxation, but the shift of tax regimes that took place at the end of the 1970s was part of a larger program, Renaissance II, that aimed at urban renewal. It is clearly impossible to disentangle fully the effects of all the various elements of the renewal effort. Nevertheless, theory and evidence together do, we believe, suggest a reasonable interpretation of the Pittsburgh experience. And we offer that interpretation to conclude our study.

The basic data are clear on one thing. Following the change in regimes at the end of the 1970s, Pittsburgh experienced a striking building boom, far in excess of anything that took place in the other major cities in the region. The building boom was basically a center city phenomenon; it did not extend to the rest of the metropolitan area. It was, moreover, a boom in commercial building activity. The residential sector experienced only a modest increase in new construction. The central thrust took the form of several major new office buildings in the CBD in response to a marked shortage in office space that characterized the transformation of the Pittsburgh economic base from its earlier heavy manufacturing orientation to a more diversified, service-oriented economy.

How do we account for the Pittsburgh building boom? It seems clear at the outset that certain underlying economic conditions were favorable. By 1980-81 the downtown office vacancy rate had fallen to less than one percent, suggesting an existing excess demand for office space. Renaissance II appears to have mobilized this excess demand and transformed it into new commercial construction. However, the excess demand itself doesn't seem to be the whole story, as two pieces of evidence suggest. First, as Table 7 indicates, Pittsburgh was not the only city in the region with low office vacancy rates in the late 1970s. But the other cities in our sample did not experience an expansion in commercial building activity anything like what happened in Pittsburgh. And, second, as we found in our regression analysis, even after allowing for the significant effect of office vacancy rates on new building activity, we find that our dummy variable for the regime change remains large and statistically significant. This suggests that while excess demand was obviously quite important, there was more than just this behind the dramatic expansion in commercial building.

This is, incidentally, an issue of considerable contention among city officials and others close to the Pittsburgh experience. Some suggest a major role for fiscal incentives. Walter Rybeck (1991), for example, quotes the Pittsburgh City Council President as follows: "I'm not going to say the land tax is the only reason a second renaissance occurred, but it's been a big help" (pp.4-5). In contrast, a major official and a close observer (independently) have asserted categorically to us that all the major projects that were undertaken in the CBD would have been undertaken in the absence of any tax reform; their view is that the shortage of office space was the basic driving force in these investment decisions.

The fiscal reform that accompanied Renaissance II had two important components: the huge increase in tax rates on land and large tax abatements on new structures. It is difficult in any rigorous econometric sense to separate the effects of these two measures. As we discussed earlier, for various reasons we doubt that the "timing effect" of the increase in the rate of taxation of land was of much importance in development decisions. In contrast, the tax abatements on structures that were offered under Renaissance II were, as we have seen, quite large in magnitude. They offered a substantial and directly visible cost reduction for new building activity. Our sense is thus that these abatements were probably the more important of the two tax incentives that we have considered in this paper.[12]

This is not, however, to downplay the role of land taxation. What the Pittsburgh experience suggests to us is that the movement to a graded tax system can, in the right setting, provide some stimulus to local building activity. The primary

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[12]Bourassa's (1987) earlier-cited econometric findings are consistent with this view.

role of the land tax in all this is to provide the additional source of revenues that allows a reduction in the rate on improvements. The tilting of the rate structure under a graded system of property taxation tends to reduce the penalty on new construction activity, while maintaining revenues through increased reliance on a tax does not discourage new construction.[13]

At the same time, it is important to remember that these fiscal incentives were put in place in a setting of strong demand for office space. We cannot conclude, from the Pittsburgh experience at least, that such fiscal incentives are in themselves capable of generating major urban renewal efforts. But in the general Pittsburgh context, it is our sense that they have played a supporting role for new urban construction. Our findings thus do not support some of the more extravagant claims that land-tax proponents have made for the effects of the tax in stimulating economic activity. But urban land taxes, while they may not provide much direct stimulus to development activities, can substitute for other taxes that penalize such undertakings.

[13]Pittsburgh has, interestingly, pushed this idea in another direction by introducing in 1990 a further increase in the tax rate on land accompanied by a substantial reduction in the city's wage tax.

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Appendix A

In this appendix, we set forth a model that captures some of the important economic effects of a land tax. Land in this model can be used either in activity A immediately or in activity B beginning next period. Land use decisions are unalterable; once land is developed, its use cannot be changed. The total amount of land in the city L must be used for either A or B. We use subscripts to denote land use, and therefore

$$L = L_A + L_B \tag{A-1}$$

where L_i, i = A or B, is the amount of demand devoted to use i. The output of good i, X_i, requires land and capital, K_i. For simplicity, we assume that structures never depreciate. Production functions exhibit constant returns to scale. If we define k_i as the capital-land ratio, then we can write the production functions as

$$\begin{aligned} X_i &= F_i(K_i, L_i) \\ &= L_i f_i(k_i) \end{aligned} \tag{A-2}$$

where $f_i' > 0$ and $f_i'' < 0$.

Land developers choose a combination of structures and land in order to minimize the cost of production. Let R_i be land rent, r be the rental rate of structures (and thus equal to the interest rate given our assumption that structures do not depreciate), t_k be the tax rate on capital, and $\psi_i(k_i)$ be the marginal rate of technical substitution. Cost minimization thus requires

$$\text{(A-3)} \qquad \psi_i(k_i) = R_i \; / \; (r + t_K).$$

We assume that developers are perfect competitors. The price of output must therefore equal the minimized cost of production $c_i(R_i, r + t_K)$ and thus

$$\text{(A-4)} \qquad P_i = c_i(R_i, r + t_K).$$

Market clearing requires

$$\text{(A-5)} \qquad X_i = D_i(P_i)$$

where P_i is the price of X_i, D_i is the demand function, and $D_i' < 0$.

Equilibrium without a Land Tax

It is helpful first to analyze this model under the assumption that there are no taxes on land. If there were no land taxes, then land values would simply be the discounted present value of land rents:

(A-6) $$V_i = R_i / r \qquad i = A,\ B.$$

A land owner must wait one period in order to realize V_B but can realize V_A immediately. If landowners are indifferent between uses, then it must be true that

(A-7) $$(1 + r)V_A = V_B$$

and therefore

(A-8) $$(1 + r)R_A = R_B.$$

A Bentick-Mills Type Tax on Land

Now suppose that land values are taxed at the rate t_L. Suppose further that, as in the Bentick (1982) and Mills (1982) models, taxes are based on the market value of a parcel of land. All land is worth V_A in the first period, and therefore all land pays a tax of t_LV_A in that period. Beginning in the second period, land used for activity A continues to pay t_LV_A, but land used for activity B pays t_LV_B. Land values are now

(A-6′) $$V_i = R_i / (r + t_L) \qquad i = A,\ B.$$

If landowners are indifferent between uses, then

(A-7′) $$(1 + r)V_A = V_B - t_L V_A$$

and therefore

(A-8′) $$(1 + r + t_L)R_A = R_B.$$

Equations (A-8) and (A-8′) show that a Bentick-Mills land tax is not neutral. Given a tax based on actual land value, land rent in use B must exceed rent in use A by an amount that compensates land owners for waiting until next period to begin to collect land rents as well the taxes that must be paid on undeveloped land during the current period. As a consequence, if we institute a Bentick-Mills land tax, land must be shifted from the future to the present (i.e., from use B to use A) until equation (A-9) holds; a Bentick-Mills land tax encourages the early development of land.

<u>Tideman-Vickrey Type Tax on Land</u>

Now, as Tideman (1982) and Vickrey (1970) propose, suppose that the tax on land is independent of the way land is actually used. In particular, suppose that taxes are levied on the value of land in its "highest and best use." This would imply that all land would pay $t_L V_A$ in the period 1 and that all land (including land in activity A) would begin to pay $t_L V_B$ per period in period 2. The model now becomes

(A-9) $$(1+r)V_A = (R_A - t_L V_A) + ((R_A - t_L V_B) / r)$$

$$V_B = (R_B - t_L V_B) / r$$

$$(1+r)V_A = -t_L V_A + V_B.$$

These three equations together imply

(A-8″) $$(1 + r)R_A = R_B$$

This is the same result as in the "no tax" model, and therefore a Tideman-Vickrey tax is neutral. This should not be surprising given the nature of the tax. By design, tax liability is independent of the way land is used and therefore cannot distort land use decisions.

Comparative Statics

Suppose there is a Bentick-Mills type tax on land, and the tax rate on land now rises. In this section we characterize the impact of this tax change on current investment, K_1.

Let a " ^ " over a variable represent a proportional change in that variable (e.g., $\hat{R}_A = dR_i / R_i$). Total differentiation of the model yields

$$\text{(A-10)} \qquad \hat{R}_A = \frac{-\gamma \hat{t}_L \theta_B (\epsilon_B s_B^L - \sigma_B s_B^K)}{\theta_B (\epsilon_B s_B^L - \sigma_B s_B^K) + \theta_A (\epsilon_A s_A^L - \sigma_A s_A^K)}$$

$$\text{(A-11)} \qquad \hat{L}_A = \hat{R}_A (\epsilon_A s_A^L - \sigma_A s_A^K)$$

$$\text{(A-12)} \qquad \hat{K}_A = s_A^L \hat{R}_A (\epsilon_A + \sigma_A)$$

where θ_i equals $L_i / (L_A + L_B)$, ϵ_i is the price elasticity of demand for X_i, σ_i is the elasticity of substitution between structures and land, γ equals $t_L / (1 + r + t_L)$, and s_i^L and s_i^K represent cost shares.

If the tax rate on land rises, then $\hat{t}_L$ is positive. ϵ_i (the price elasticity of demand) is negative and σ_i (the elasticity of substitution between capital and land) is positive. Therefore, $\hat{R}_A$ is negative. Equation (A-11) shows that given that $\hat{R}_A$ is negative, more land is developed in the current period, i.e. $\hat{L}_A$ is positive. Equation (A-12) characterizes the "timing effect" we discussed in the text of the paper. It shows that the impact of an increase in the tax rate on land on current period investment is, in principle, ambiguous; the sign of $\hat{K}_A$ depends on the magnitudes of the elasticity of demand for X_A and the elasticity of substitution between structures and land.

We can offer the following interpretation of this result. When the tax on land rises, the cost of waiting to use land in activity B rises. Thus more land is used in A and less in B. As a consequence, land rent in activity A falls and the price of X_A falls (since more is produced). This generates output and substitution effects for K_A; the capital-land ratio falls because R_A is lower (and therefore less K_A is used) and more X_A is produced (and therefore more K_A is used). The magnitude of these effects is determined by the two elasticities.[14]

We can also offer a conjecture on the sign of this result in practice. Typically, we would expect to find that the elasticity of demand is larger (in absolute value) than the elasticity of substitution. If the market is "small" in some sense, then

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[14] The impact of an increase in the tax rate on land on total investment in the two periods is ambiguous, in part because of the possibility that the structures-land ratio might be different in the two periods. For example, if use B is significantly more structures intensive than use A, then an increase in the land tax that caused a shift in land from B to A might lower total investment.

demand will be very elastic, while the elasticity of substitution is unlikely to be larger than 1. Thus, except in very large urban markets where the elasticity of demand might be small, we would expect that an increase in a Bentick-Mills type land tax will increase current period investment, i.e., $\hat{K}_A$ will be positive.

Appendix B: Description of the Data

The variables that we seek to explain in this paper are various measures of the level of planned building activity in our sample of cities. We have two basic sources for these variables. The first is the Dun and Bradstreet Corporation (DB). As part of their "Current Economic Indicators," Dun and Bradstreet publishes on a monthly basis the value of building permits for the nations 202 largest cities. From the monthly data, we constructed an annual time series on building permit values reaching back to 1960 for each of the cities in the sample. We converted the series to real terms by deflating the DB figures by the GNP implicit price deflator for the nonresidential structures component of fixed private investment. We note that these data refer to the center city alone, not to the wider metropolitan area, and that they are not disaggregated by type of construction.

Our second source of data on the value of new building permits is the U.S. Bureau of the Census Building Permit Data. Assembling these data was considerably more complicated. In terms of coverage over time, we have been able to pull together data for 1974 through 1978 and for 1980 through 1989; we have been unable to get data for the single year 1979. Hence, our "before and after" figures in Table 4 in the text refer to the periods 1974-78 and 1980-89. We encountered a further problem in that the Census retired the MSA concept in 1984 and specified metropolitan areas as MSA's or PMSA's. This involved some substantive changes (i.e., additions or deletions of counties) for five of the metropolitan areas in our sample (including Pittsburgh). We thus had to adjust the figures for years subsequent to 1983 by obtaining the relevant county data and adjusting the data. The great appeal of the Census data is its disaggregation. First, the data are broken down between city and suburbs, and, second, they are disaggregated into some 23 different types of construction activity. This has allowed us in our Table 4 to distinguish both between city and suburbs and between permits for residential and nonresidential construction. We have deflated these data in the same manner as the DB figures.

Our starting point for the data on tax rates was Pollakowski (1982), Table 1 (p. 2). We obtained help from the Chief Accounting Officer, Mark D. Gibbons, in the Office of the City Controller in updating this table and in correcting a couple of errors.

Finally, the source of data for city office vacancy rates is the Building Owners and Managers Association International

(BOMA). They publish annually the BOMA Experience Exchange Report, which contains a wealth of information on city office buildings, including estimated occupancy rates. We were able to construct a time series for Pittsburgh reaching all the way back to 1960 to coincide with our DB data on new building permits. We were not able, however, to get such complete data for all the cities in our sample. We thus have office vacancy rates only for selected years for most of the other cities in the region.

TABLE 1

Land-Value Taxation: A Numerical Example

1. Notation and assumptions:

R_A = Annual rent in perpetuity on project A beginning at time zero
= \$1,000

R_B = Annual rent in perpetuity on project B beginning at time one
= \$1,100

r = Rate of interest
= .10

$V_A(0)$ = Value of land if used for project A at time zero

$V_B(0)$ = Value of land at time zero if used for project B at time one (and held idle during the first period)

$V_B(1)$ = Value of land at time one if used for project B at time one (and held idle during the first period)

2. Case of no taxation: $V_A(0) = V_B(0)$

$V_A(0) = R_A/r = 1,000/.1 = \$10,000$
$V_B(1) = R_B/r = 1,100/.1 = \$11,000$
$V_B(0) = V_B(1)/(1+r) = 11,000/1.1 = \$10,000$

3. Taxation of land rent with tax rate t=.2: $V_A(0) = V_B(0)$

$V_A(0) = (R_A - tR_A)/r = 800/.1 = \$8,000$
$V_B(1) = (R_B - tR_B)/r = 880/.1 = \$8,800$
$V_B(0) = V_B(1)/(1+r) = 8,800/1.1 = \$8,000$

4. Taxation of land value with tax rate of t=.02: $V_A(0) > V_B(0)$

$V_A(0) = (R_A - tV_A)/r = R_A/(r+t) = 1,000/.12 = \$8,333$
$V_B(1) = (R_B - tV_B)/r = R_B/(r+t) = 1,100/.12 = \$9,167$
$V_B(0) = V_B(1)/(1+r) - tV_B(0) = 8,333 - tV_B(0) = \$8,170 < V_A(0)$

Note: $V_A(0)=V_B(0)$ if land is not taxed before it is developed.

TABLE 2

PROPERTY TAX RATES, CITY OF PITTSBURGH 1972-1991

Fiscal Year	(a) Land Tax Rate (mills)	(b) Structure Tax Rate (mills)	(c) County Tax Rate (mills)	(d) School District Tax Rate (mills)	(e) Total Land Tax Rate (mills)	(f) Total Structure Tax Rate (mills)	(g) (e) as a percent of (f)
1972	53	26.5	15.5	23	91.5	65.0	141
1973	51	25.5	15.5	23	89.5	64.0	140
1974	51	25.5	15.5	23	89.5	64.0	140
1975	49.5	24.75	15.5	23	88.0	63.25	139
1976	49.5	24.75	15.5	29	94.0	69.25	136
1977	49.5	24.75	21.375	29	99.875	75.125	133
1978	49.5	24.75	21.375	29	99.875	75.125	133
1979	97.5	24.75	21.365	29	145.865	73.115	200
1980	125.5	24.75	23.0	29	177.5	76.75	231
1981	125.5	24.75	28.0	41	194.5	93.75	207
1982	133.0	32.0	29.0	36	198.0	97.0	204
1983	151.5	27.0	29.0	36	216.5	92.0	235
1984	151.5	27.0	29.0	40	220.5	96.0	230
1985	151.5	27.0	29.0	40	220.5	96.0	230
1986	151.5	27.0	31.25	46	222.75	98.25	227
1987	151.5	27.0	31.25	46	228.75	104.25	219

1988	151.5	27.0	31.25	46	228.75	104.25	219
1989	151.5	27.0	35.0	46	232.5	108.0	215
1990	184.5	32.0	36.5	46	267.0	114.5	233
1991	184.5	32.0	36.5	46	267.0	114.5	233

Source: Office of the City Controller, City of Pittsburgh

Table 3
Average Annual Value of Building Permits
Dun and Bradstreet Data

	1960-1979	1980-1989	Percent Change
Akron	134,026	87,907	-34.41
Allentown	48,124	28,801	-40.15
Buffalo	93,749	82,930	-11.54
Canton	40,235	24,251	-39.73
Cincinnati	318,248	231,561	-27.24
Cleveland	329,511	224,587	-31.84
Columbus	456,580	527,026	15.43
Dayton	107,798	92,249	-14.42
Detroit	368,894	277,783	-24.70
Erie	48,353	22,761	-52.93
Pittsburgh	181,734	309,727	70.43
Rochester	118,726	82,411	-30.59
Syracuse	94,503	53,673	-43.21
Toledo	138,384	93,495	-32.44
Youngstown	33,688	11,120	-66.99
15 City Average	167,504	143,352	-14.42

Note: All data are in 000's of constant 1982 dollars

Table 4
Summary of Regression Results
Dun and Bradstreet Data

	Model 1			Model 2			
	Post-1979 Dummy	Constant	R^2	Year	Post-1979 Dummy	Constant	R^2
Akron	-0.385234 (3.202)	11.751752 169.196	.2681	-0.034446 (3.633)	0.131457 (0.755)	79.593305 (4.262)	.5084
Allentown	-0.500479 (3.561)	10.716497 132.053	.3117	-0.020815 (1.612)	-0.188249 (0.794)	51.712287 (2.034)	.3721
Buffalo	-0.088154 (0.434)	11.316098 96.511	.0067	-0.053820 (3.250)	0.719152 (2.365)	117.315456 (3.597)	.2860
Canton	-0.451254 (2.519)	10.484291 101.375	.1848	0.003943 (0.229)	-0.510395 (1.615)	2.719012 (0.080)	.1863
Cincinnati	-0.303061 (2.721)	12.627438 196.391	.2092	-0.025195 (2.638)	0.074870 (0.427)	62.249832 (3.310)	.3713
Cleveland	-0.360180 (2.860)	12.651502 174.027	.2261	-0.032223 (3.098)	0.123165 (0.645)	76.114723 (3.716)	.4291
Columbus	0.150033 (1.566)	13.00122013 .001220	.0806	0.013371 (1.512)	-0.050539 (0.311)	-13.333774 (0.765)	.1523
Dayton	-0.144628 (0.998)	11.515611 137.702	.0344	-0.006177 (0.445)	-0.051969 (0.204)	23.681709 (0.866)	.0414
Detroit	-0.283161 (2.500)	12.779120 (195.411)	.1825	-0.027083 (2.831)	0.123083 (0.701)	66.118883 (3.510)	.3696

Erie	-0.703141 (5.100)	10.707515 (134.519)	.4816	0.002964 (0.224)	-0.747596 (3.074)	4.870516 (0.187)	.4825
Pittsburgh	0.466967 (2.811)	12.032693 (125.450)	.2201	-0.030792 (2.075)	0.928851 (3.409)	72.678094 (2.487)	.3274
Rochester	-0.295582 (1.979)	11.592803 (134.456)	.1227	-0.010128 (0.712)	-0.143655 (0.550)	31.540793 (1.125)	.1389
Syracuse	-0.468217 (1.960)	11.278138 (81.764)	.1206	-0.027911 (1.249)	-0.049550 (0.121)	66.249099 (1.506)	.1687
Toledo	-0.375469 (3.627)	11.799579 (197.403)	.3196	0.014699 (1.540)	-0.595955 (3.400)	-17.150142 (0.912)	.3745
Youngstown	-1.048632 (6.220)	10.315982 (105.991)	.5802	-0.030820 (2.043)	-0.586338 (2.116)	71.015272 (2.390)	.6364

Note: t-statistics in parentheses

Table 5

Average Annual Value of Building Permits

U.S. Census Data

COMMUNITY	1974-78			1980-89		
	CITY	SUBURB	MSA	CITY	SUBURB	MSA
AKRON						
Residential	28,239.1	188,024.7	216,263.8	27,930.2	124,320.1	152,250.2
Nonresidential	61,680.0	60,016.7	121,696.7	46,425.1	83,458.3	129,883.4
Total	89,919.1	248,041.4	337,960.5	74,355.3	207,778.3	282,133.6
ALLENTOWN						
Residential	26,448.6	143,925.2	170,373.8	20,280.5	196,731.1	217,011.6
Nonresidential	34,957.7	64,490.5	99,448.2	29,898.5	109,895.3	139,793.8
Total	61,406.3	208,415.8	269,822.1	50,179.0	306,626.4	356,805.4
BUFFALO						
Residential	8,447.0	183,765.9	192,212.9	8,385.7	179,261.1	187,646.8
Nonresidential	25,474.9	136,969.0	162,443.9	33,697.4	129,651.9	163,349.3
Total	33,921.9	320,734.9	354,656.8	42,083.1	308,913.1	350,996.1
CANTON						
Residential	11,607.9	122,660.2	134,268.1	6,160.7	60,512.6	66,673.3
Nonresidential	14,896.6	47,132.2	62,028.8	17,720.6	44,343.1	62,063.8
Total	26,504.5	169,792.4	196,296.9	23,881.3	104,855.7	128,737.1

COMMUNITY	1974-78			1980-89		
	CITY	SUBURB	MSA	CITY	SUBURB	MSA
CINCINNATI						
Residential	36,123.1	374,212.4	410,335.5	20,238.2	344,201.0	364,439.2
Nonresidential	74,949.7	200,557.3	275,507.0	99,482.9	308,337.6	407,820.5
Total	111,072.8	574,769.7	685,842.5	119,721.1	652,538.6	772,259.8
CLEVELAND						
Residential	30,254.2	558,518.4	588,772.6	28,602.6	384,035.5	412,638.1
Nonresidential	182,789.6	419,515.7	602,305.3	201,873.6	277,133.6	479,007.2
Total	213,043.9	978,034.1	1191,078.0	230,476.2	661,169.1	891,645.3
COLUMBUS						
Residential	153,306.0	226,599.1	379,905.1	216,897.4	241,788.8	458,686.2
Nonresidential	207,045.2	52,714.8	259,760.1	318,663.0	108,639.1	427,302.1
Total	360,351.3	279,313.9	639,665.1	535,560.4	350,427.9	885,988.3
DAYTON						
Residential	7,790.0	218,592.9	226,382.9	9,469.3	140,547.8	150,017.1
Nonresidential	72,792.8	107,213.4	180,006.3	63,031.3	105,572.5	168,603.8
Total	80,582.8	325,806.3	406,389.1	72,500.5	246,120.4	318,620.9

COMMUNITY	1974-78			1980-89		
	CITY	SUBURB	MSA	CITY	SUBURB	MSA
DETROIT						
Residential	53,939.1	1235,572.5	1289,511.6	49,412.1	902,073.4	951,485.5
Nonresidential	198,925.1	664,399.5	863,324.6	187,437.9	909,042.7	1096,480.6
Total	252,864.2	1899,972.0	2152,836.1	236,850.0	1811,116.1	2047,966.0
ERIE						
Residential	10,955.7	41,776.7	52,732.4	4,129.8	29,440.3	33,570.1
Nonresidential	23,113.6	18,203.9	41,317.5	17,052.0	18,845.2	35,897.2
Total	34,069.3	59,980.6	94,049.9	21,181.8	48,285.5	69,467.3
PITTSBURGH						
Residential	35,933.9	425,064.8	460,998.7	43,349.5	295,294.3	338,643.8
Nonresidential	63,467.3	217,861.5	281,328.8	211,749.3	227,749.1	439,498.4
Total	99,401.2	642,926.3	742,327.5	255,098.8	523,043.4	778,142.2
ROCHESTER						
Residential	3,508.0	194,534.4	198,042.4	9,220.6	280,917.9	290,138.4
Nonresidential	77,452.0	107,759.2	185,211.2	66,538.5	151,044.7	217,583.2
Total	80,960.0	302,293.6	383,253.6	75,759.1	431,962.6	507,721.6

COMMUNITY	1974-78			1980-89		
	CITY	SUBURB	MSA	CITY	SUBURB	MSA
SYRACUSE						
Residential	9,060.2	101,339.0	110,399.2	7,346.1	125,347.7	132,693.8
Nonresidential	16,168.7	47,338.0	63,506.7	34,473.7	77,838.3	112,312.0
Total	25,228.9	148,677.1	173,905.9	41,819.8	203,186.0	245,005.8
TOLEDO						
Residential	57,844.8	177,223.8	235,068.6	33,996.3	146,666.7	180,663.0
Nonresidential	53,465.3	83,833.4	137,298.7	56,700.0	88,513.8	145,213.8
Total	111,310.1	261,057.2	372,367.3	90,696.4	235,180.4	325,876.8
YOUNGSTOWN						
Residential	13,667.6	107,541.3	121,208.9	5,705.1	49,797.6	55,502.7
Nonresidential	20,941.8	31,499.4	52,441.1	18,533.4	51,903.9	70,437.3
Total	34,609.4	139,040.6	173,650.1	24,238.5	101,701.5	125,940.0

Note: all data are in 000's of constant 1982 dollars

Table 6

Summary of Regression Results
Pittsburgh Subsample, Census Data

	Model 1			Model 2			
	Post-1979 Dummy	Constant	R^2	Year	Post-1979 Dummy	Constant	R^2
CITY							
Residential	0.167876 (0.738)	10.42853 (56.159)	.0402	-.062775 (1.527)	0.701461 (1.706)	134.47140 (1.655)	.1963
Nonresidential	1.084919 (4.088)	11.03715 (50.939)	.5625	-.052692 (1.050)	1.532800 (3.055)	115.15623 (1.161)	.5993
Office	1.966581 (2.119)	8.52419 (11.250)	.2568	-.272954 (1.649)	4.286687 (2.589)	547.88066 (1.675)	.3940
SUBURB							
Residential	-0.365985 (2.618)	12.93318 (113.298)	.3452	0.083142 (6.080)	-1.072693 (7.844)	-151.35585 (5.601)	.8395
Nonresidential	0.087293 (0.636)	12.23811 (109.241)	.0302	.040887 (1.675)	-.260250 (1.066)	-68.55531 (1.422)	.2140
Office	0.495360 (2.549)	10.20650 (64.313)	.3332	0.077405 (2.478)	-0.162581 (0.521)	-142.74541 (2.313)	.5589

Note: t-statistics in parentheses

Table 7

Downtown Office Vacancy Rates
Selected Cities
1977-1988

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Akron	6.3	3.9	1.3	1.2	0.7	1.1	3.1	2.6	9.1	13.4	19.7	9.5
Buffalo	0.6	3.3	1.0	1.0	1.3	1.4	2.7	9.0	19.6	4.4	4.1	5.7
Cincinnati	20.9	4.6	5.7	4.4	5.7	7.3	7.9	3.0	6.7	9.5	3.7	10.0
Cleveland	2.1	2.0	0.6	2.0	3.5	3.0	3.2	3.1	9.4	9.3	14.2	7.6
Columbus	--	5.8	3.2	1.5	--	3.8	5.8	7.5	13.9	4.7	5.3	6.7
Dayton	--	4.2	6.9	3.7	9.7	--	--	8.7	10.7	9.1	7.8	5.5
Detroit	12.0	10.4	7.2	8.3	6.3	13.6	7.5	23.7	6.4	5.1	8.0	3.7
Pittsburgh	12.1	3.5	3.0	0.8	0.8	2.8	9.1	12.6	12.9	12.1	11.2	10.4
Syracuse	--	--	--	--	1.8	0.3	9.4	8.0	7.0	3.1	1.5	4.6
Toledo	3.3	2.4	1.4	--	16.0	4.2	7.6	3.6	--	10.8	10.9	10.6

Source: BOMA Experience Exchange Report, various years