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The Impact of Two-Rate Property Taxes on Construction in Pennsylvania

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I. Introduction

Property taxes in the U.S. are generally levied at the same rate on land as on improvements. Cities in Pennsylvania, however, are allowed to levy property taxes at different rates on land than on improvements. And taxes on land have very different effects than taxes on improvements.

A tax on land is the best example of what economists call a neutral tax. That is, a tax on land does not cause people to behave in inefficient ways. Four conditions must be met for a tax on land to be neutral. First, there must be no impediments or friction in the operation of markets. Second, the owners and potential owners of land must have accurate understandings of the returns that they will receive from alternative improvements. Third, the tax bill must be completely independent of any action that the owner of the land might take. Fourth, people must be confident that the tax bill will never exceed the value of using the land. If these conditions are met, then the perfect operation of markets will ensure that land is in the hands of those who can use it best, and the characteristics of the land tax will ensure that neither changing from a more efficient to a less efficient use of the land nor abandoning the land will raise the net return from the land, so the owner will do best by using the land most efficiently.

The assumption that there is no friction in markets may seem extreme. But if this condition is not met, there is reason to believe that a tax on land will be not merely neutral, but better than neutral. The reason is that an important market friction is the friction in lending markets, which leads to interest rates being different for different people — higher for borrowers than for lenders. If two people are both prepared to pay $10,000 per year for the use of land, this will translate into an offer of $100,000 for someone with an interest rate of

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10%, and $200,000 for someone with an interest rate of 5%. The person with a 10% interest rate will need to value the annual use of land at $20,000 per year to outbid a person with a 5% interest rate and a $10,000 annual value. Thus the land will tend to be owned by people with low interest rates, who will often not be the ones who place the highest value on the use of land. However, if there is a tax of $4,000 per year on the land, then the person with a 5% interest rate will find that ownership of the land is worth only $6,000/.05 or $120,000. Now, if the person with the 10% interest rate values the use of the land at just $16,000 (that is, $12,000 after taxes) then he will find it worthwhile to match the bid of the person with a 5% interest rate. Thus taxing land tends to put land in the hands of persons who are excluded from owning land by capital market imperfections.

If people are not always able to predict what uses of land will be profitable in the future, then there will be a possibility of land speculation. Speculators make profits by owning land when everyone comes to realize that land has potential uses that the speculators saw first. But speculators can also be disappointed, believing in futures that do not materialize. A tax on land raises the cost of holding land unused and reduces the price at which it can eventually be sold, so it tends to discourage land speculation. When land speculation is highly profitable, a community is subject to an artificial scarcity of land, because those who have the most extreme beliefs about how valuable land will be in the future will tend to buy land and leave it unused. A tax on land reduces this social cost of land speculation.

While a tax on land is thus either neutral or beneficial, the other half of the property tax, the tax on improvements, has adverse economic effects. The tax adds to the annual return that an owner of land must foresee from an improvement to make the improvement worthwhile and therefore discourages people from making improvements. Thus one would expect that a shift of taxes from building to land would result in greater construction and more efficient use of land. This paper analyzes the effect on construction of shifting taxes from buildings to land in 15 Pennsylvania cities.

II. Categories of Analysis

The U.S. Bureau of the Census publishes the number and the value of building permits in 21 categories of construction for U.S. municipalities. The 21 categories are described in detail in Appendix A. The census figures are derived from monthly reports submitted by municipalities. When municipalities fail to provide the reports for some or all months, the Bureau of the Census estimates what the reports would show, but they publish both the numbers from actual reports and their estimates including adjustments for missing information.

The 21 categories of construction fall into two broad classes: residential and non-residential. Since the forces that affect non-residential construction differ from the forces that affect residential construction, we analyze the two classes of construction separately.

There are six Census categories of residential construction:

Single-family dwellings
Two-family dwellings
Three- and four-family dwellings
Dwellings for five or more families

Additions alterations and conversions
Garages and carports

We divided these into two groups for purpose of analysis: The first four, which involve the construction of whole housing units, and the last two which do not.

Among the fifteen categories of non-residential construction, there are six that tend to be dominated by public and tax-exempt structures:

Churches and other religious buildings
Hospitals and institutional buildings
Public works and utility buildings
Schools and other educational buildings
Other non-residential buildings (including jails and post offices)
Structures other than buildings (including parks, marinas, and stadiums)

We exclude these from our analysis because we want to focus on construction activity that is promoted by reductions in taxes on improvements. The nine categories that remain are:

Hotels, motels and tourist cabins
Other non-housekeeping shelter
Amusement, social and recreational buildings
Industrial buildings
Parking garages
Service stations and repair garages
Office, bank and professional buildings
Stores and customer service buildings

Additions, alterations and conversions to non-residential buildings

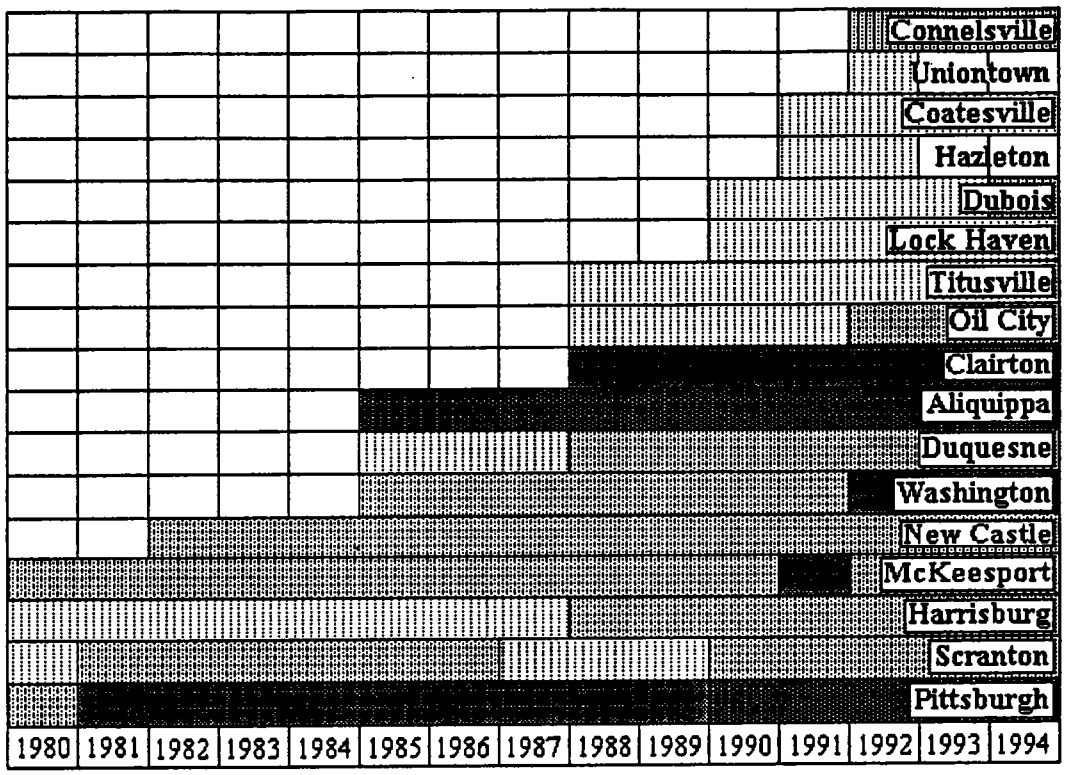
Again, we make separate analyses of whole buildings and other construction.

III. Municipalities Analyzed

In 1913 Pennsylvania passed a law that permitted its "second class cities" (Pittsburgh and Scranton) to tax improvements at twice the rate of land, and these cities began to do so. In the mid-1970s, a law was passed that permitted all of the state's 55 cities to tax land and improvements at whatever separate rates they chose. Harrisburg adopted two-rate taxes in 1975, and 14 other cities followed, beginning in 1980 (Figure 1). Two of these (Hazleton and Unionville) rescinded the dual rates within two years. Since the recision might have been predicted, which would eliminate any incentive for construction from a long-run reduction in taxes, these cities are treated in this analysis as if they did not use two-rate taxes at all.

The 15 Pennsylvania cities that have implemented a two-rate tax and kept it for more than two years are not a random sample of Pennsylvania municipalities. One important correlate of high growth in municipalities is existing density of population. Places with high densities generally need to demolish existing structures before they can build new ones. The opportunity cost of doing so retards construction. Also, as incomes rise, people tend to choose less dense housing arrangements, leading to a flattening of the density gradient around central cities. These facts make central cities less likely to grow, and the Pennsylvania municipalities that have used two rate taxes tend to be central cities.

Figure 1



Effective Tax Differential:

< 1 %

1% - 2%

2% - 3%

> 3%

Cities with two-rate taxes between 1980 and 1994

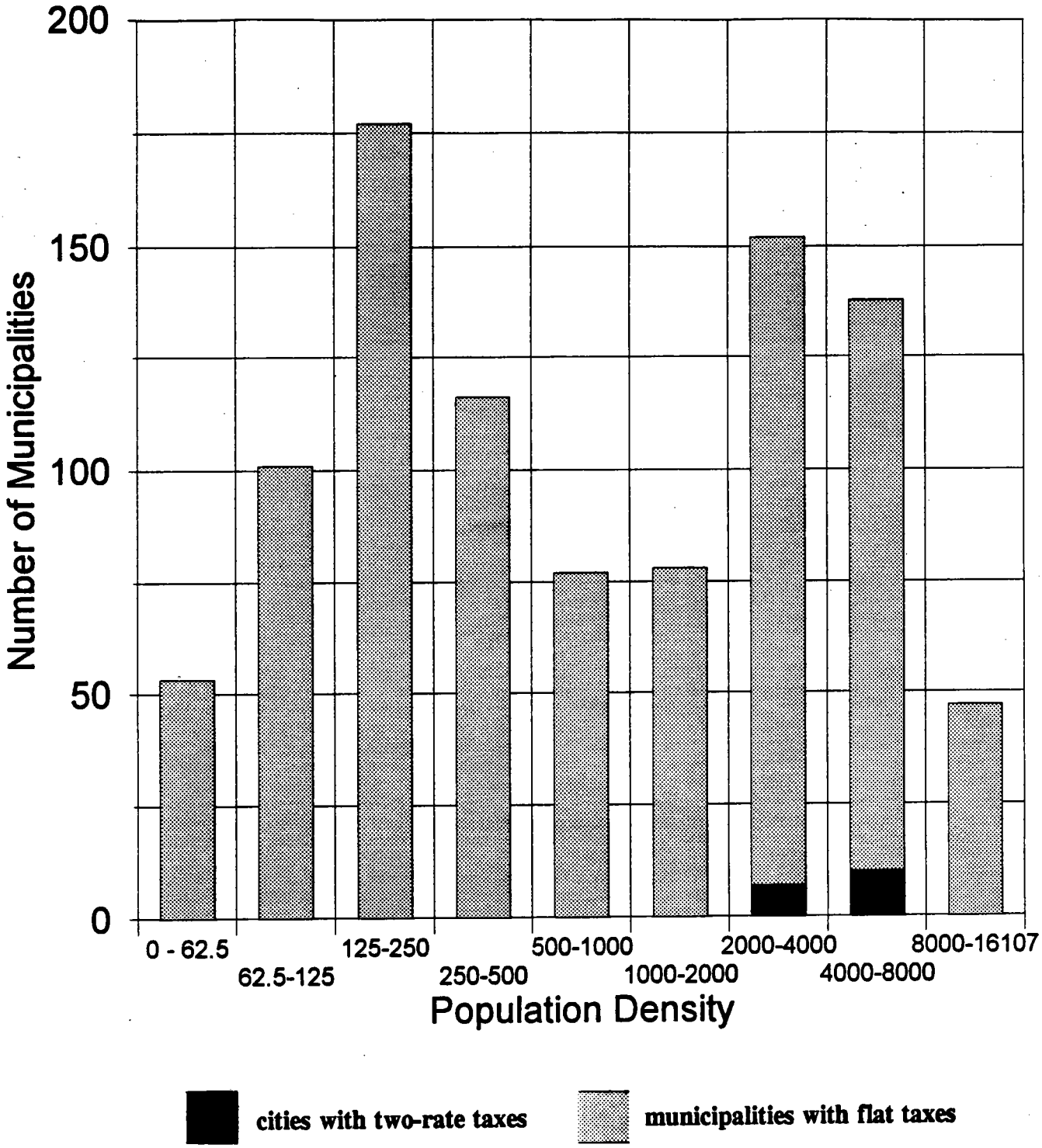
The concentration of two-rate municipalities among central cities arises from history, politics, and the way that Pennsylvania classifies municipalities. Pennsylvania has three types of municipalities: cities, boroughs, and townships. Every plot of land is in exactly one municipality, of one of these types. While cities are generally larger and more densely settled than boroughs, and boroughs larger and more densely settled than townships, these dominance relations are not universal. Some boroughs and townships are as large and as densely settled as the average city. Because the municipalities that first sought permission to use two-rate taxes were cities, and because it is easier to get a law passed if its consequences are limited, the laws that Pennsylvania passed permitting two-rate taxes applied only to cities.

Figure 2 shows the distribution of population density in 1980 among the 879 Pennsylvania municipalities with more than 2500 residents in 1980, and among the 15 two-rate cities. It is clear that the two-rate cities are more densely populated than most municipalities, but not among the most densely populated. Since the density of population is likely to affect the response of construction to tax incentives, and since all of the two-rate cities had densities between 2,000 and 8,000 persons per square mile, we decided to confine our analysis to municipalities in that range.

Figure 3 shows the distribution of 1979 per capita income in the 281 municipalities with 1980 population densities between 2,000 and 8,000 persons per square mile, and in the 15 two-rate cities. It is clear that the two-rate cities generally have lower per capita incomes than most municipalities in this density range.

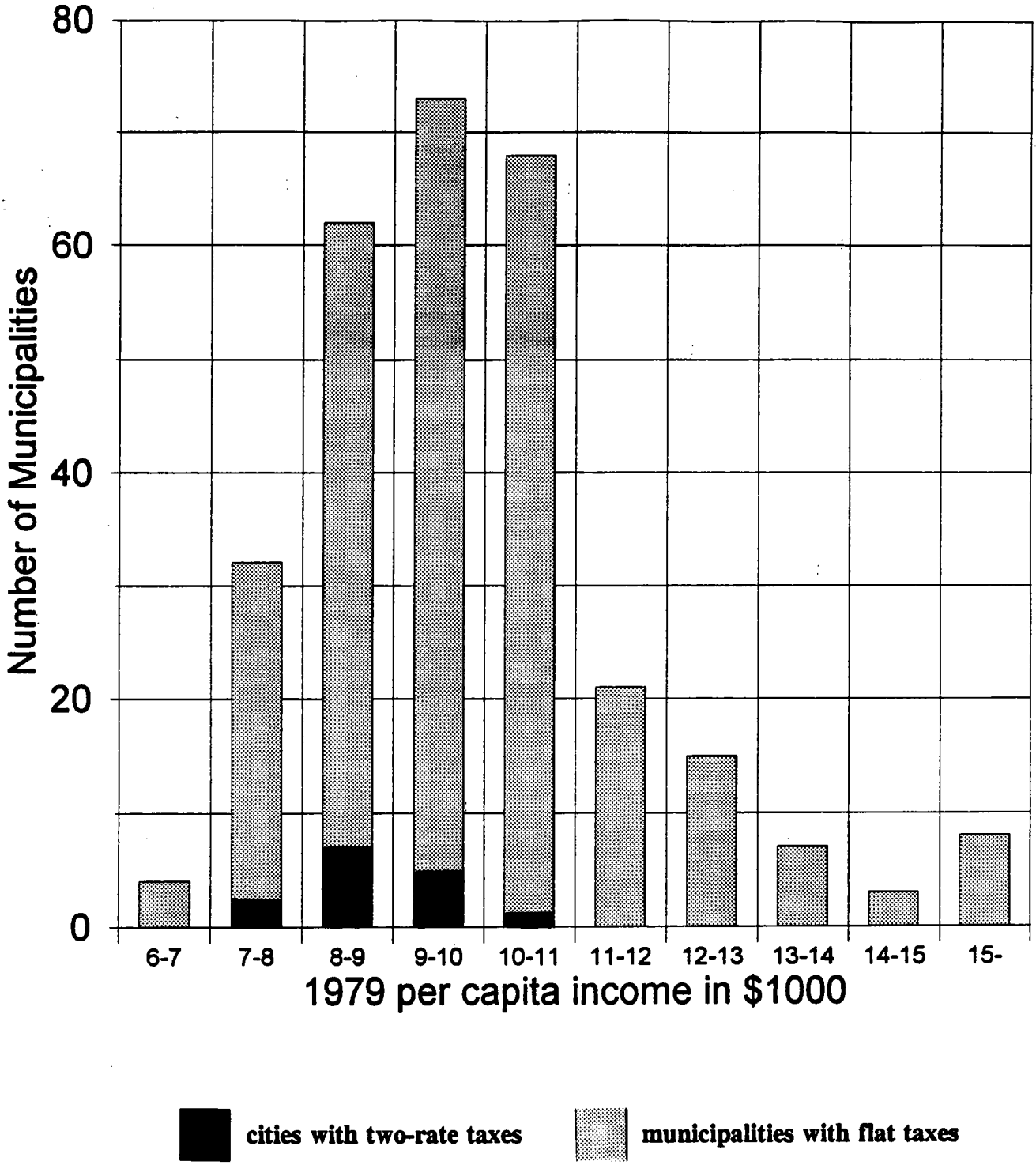
Per capita income is likely to affect the way that construction responds to tax incentives. Besides the fact that people with less money are less likely to be in a position to buy new houses, there is the connection between lower incomes and fewer attractive employment possibilities, making a municipality less likely to attract new residents. Since all 15 two-rate cities had 1979 per capita incomes between $7,300 and $10,100, we decided to restrict our analysis to municipalities with per capita incomes in the range of $6,000 to $10,250. This decision reduced the number of municipalities in the analysis to 186.

Figure 2



Distribution of population density in 1980 among the 879 municipalities with more than 2500 residents in 1979, and among the 15 two-rate cities

Figure 3



Distribution of 1979 per capita income among the 281 municipalities with 1980 population densities between 2000 and 8000 persons per square mile, and among the 15 two-rate cities

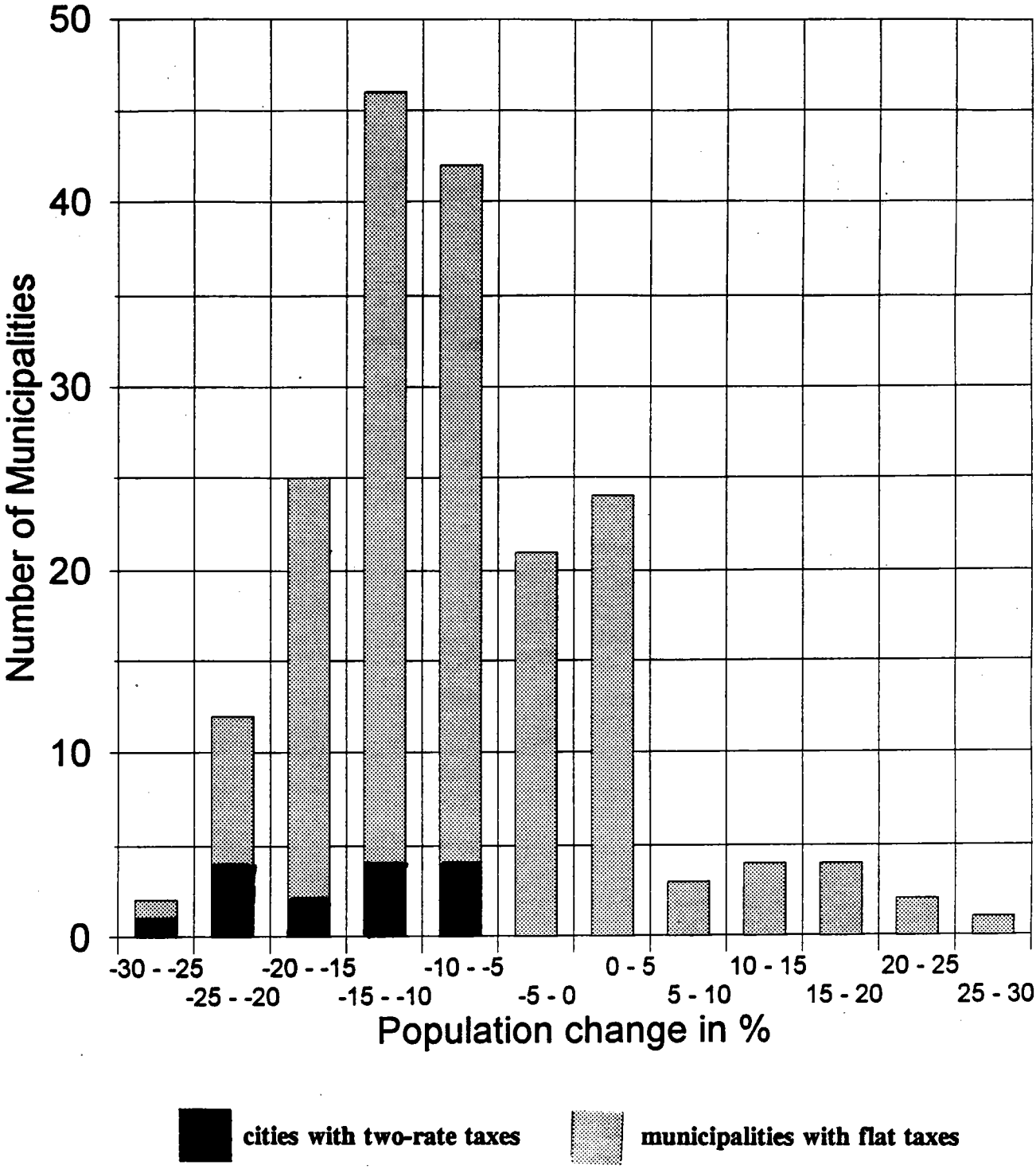
Figure 4 shows the distribution over these 186 municipalities (and over the 15 two-rate cities) of the proportion of population gained or lost between 1970 and 1980. This figure shows that in the decade before the great expansion of two-rate taxation, the cities that moved to two tax rates had substantially greater rates of population loss than the other municipalities. Population loss is associated with economic distress. It may be that this distress was one of the factors that induced cities to move to two tax rates. But the distress would also tend to depress construction. Therefore, to maintain comparability between the municipalities with and without two-rates, we confined the analysis to municipalities that lost at least 5% of their population between 1970 and 1980. This reduced our sample to 127 municipalities. Two of these did not report any information about building permits to the Bureau of the Census. The removal of these reduced our sample to 125 municipalities, of which 15 were the two-rate cities.

For each of the four categories of construction in the 125 municipalities, we plan to analyze both the number of building permits and the average value per permit. However, we have not yet completed the analysis of the number of building permits. Thus what is reported here is only our analysis of the average value of building permits in the different categories of construction.

IV. Analysis of Value per Permit

An issue that complicates the analysis of construction permit data is missing observations. Table 1 shows the distribution of missing months and missing years in the municipalities in our sample. An analysis confined to municipalities without missing data would be a very limited and potentially biased analysis. Therefore we decided that we needed a procedure that could deal with missing observations. But we were reluctant to use the data that the Bureau of the Census corrects for missing observations, because of the possibility that the interest of the Bureau of the Census in aggregate estimates would lead them to procedures that were

Figure 4



Distribution of the proportion of population gained or lost between 1970 and 1980 among 186 municipalities, and among the 15 two-rate cities

Table 1

Missing Months

41-50				1												
31-40		1						1								
21-30	3	1	1		2					1						
11-20	8	3	2	1	1	2	2	2	1				1			
1-10	24	2	4	4	1	1	1			1						
0	27	9	4	1	2	1	1	2	1		4				1	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Missing Years

Distribution of missing months and missing years among 125 municipalities

inefficient when analyzing individual municipalities. Therefore we decided to tolerate missing observations.

For each category of construction, for each municipality and year, the variable that we analyze is the total value of building permits divided by the number of "units" constructed. For residential housing, the number of units is the number of housing units. For the other categories of construction, it is the number of buildings or additions. If no permits were issued for a category of construction in a municipality in a year, then that municipality and year is treated as a missing observation for that category of construction.

Because we believe that variations in value per unit are proportional to their value, we take the logarithm of value per unit, in order to obtain a variable that will have uniform variations (homoskedasticity) across municipalities and years. We divide the value per unit by the average value per unit for all units in that category in that year to obtain a variable that is unaffected by the trend in average value over time. Thus our dependent variable is:

$$\ln\left(\frac{AV_{c,m,y}}{AV_{c,y}}\right)$$

where $AV_{c,m,y}$ is the average value of permits in category c that were issued in municipality m in year y and $AV_{c,y}$ is the average value of permits in that category in all municipalities in that year.

On the other side of the equation are an intercept and three explanatory variables. First is the logarithm of the ratio of average income in the municipality in that year to average income in all municipalities in that year. Income in each municipality in each year is interpolated linearly on the basis of data for 1979, 1985 and 1989. The figures for 1989 are used for all years after 1989. Average income for all municipalities is obtained by weighting the income for each municipality by the number of units in the category under consideration for which the municipality issued permits in that year.

The second variable is the logarithm of the ratio of population density in a municipality in a year to the average population density in a that year. Population density in a municipality for 1980 and 1990 is calculated as population in that year divided by the municipality's area. Population density for years in between is obtained by linear interpolation, while the figures for 1990 are used for years after 1990. Average population density for all municipalities is obtained by weighting the population density for each municipality by the number of units in the category under consideration for which the municipality issued permits in that year.

The third explanatory variable is the "effective tax differential," that is, the difference between the effective tax rate on land and the effective tax rate on improvements. The effective tax rate is the nominal tax rate multiplied by the ratio of assessed value to market value.

We take the tax differential because we would not expect taxes on buildings to always have a negative effect, since taxes yield revenue that can finance public services that can be valuable enough in promoting construction to outweigh the discouraging effect of the tax. But for any given level of revenue, shifting the tax from buildings to land should always promote construction.

To measure the ratio of assessed value to market value, we use figures from the Pennsylvania State Tax Equalization Board (STEB). STEB publishes annual figures on the ratio of assessed value to market value in different jurisdictions. (These ratios are called "common level ratios" in Pennsylvania). However, the figures in these mandated reports are calculated by a formula that includes political as well as statistical considerations. Therefore we sought more reliable numbers. Through the cooperation of Mr. Paul Weis, the former Director of STEB, and also his successor Mr. Thomas Connolly, we received some of the raw ratios of sales values to market values from which STEB calculates common level ratios. Because our data were incomplete, we did not seek to estimate a different assessment ratio for each year. Instead we used the average of the assessment ratios in the years that were

available to us as the assessment ratio for all years, except where the ratio jumped so rapidly that it was clear that a change in assessment policy had occurred.

While this measure is admittedly imperfect, it should be noted that, when one is analyzing the impact of taxes on construction, the average assessment ratio is not necessarily the economically relevant statistic. What we really want to know is the typical belief of people who are thinking about undertaking construction regarding the ratio of taxable value to market value that will be assigned to new construction. This number probably does not change with all changes in market prices.

Putting all of the variables together, the equation we estimated is:

$$\ln\left(\frac{AV_{c,m,y}}{AV_{c,y}}\right) = a_0 + a_1 \ln\left(\frac{AI_{c,m,y}}{AI_{c,y}}\right) + a_2 \ln\left(\frac{AD_{c,m,y}}{AD_{c,y}}\right) + a_3 ETD_{m,y} + \varepsilon,$$

where *AI* stands for average income, *AD* stands for average population density, *ETD* stands for effective tax differential and ε is an error term.

Two further transformations of the equation were made to achieve statistical validity. Note first that a figure for average value per building that is, say, 20% above the average is much more surprising if it is the average of 100 units than if it is the average of 5 units. The adjustment to take account of this is made by weighting each observation by the square root of the number of units.

The final adjustment concerns the fact that when one examines the deviations from the average value across years for a given construction category and municipality, the deviation for any year will tend to be correlated with that for the previous year. The standard adjustment for this is to estimate an equation obtained by subtracting a fraction of the previous year's equation from the current year's equation. Whenever the observation for the previous year was present, this was done.

The results are shown in Table 2. The income elasticity of -3.5% for residential construction is puzzling. The explanation might be that average income in a city is not highly

Table 2 Estimated coefficients for the average value of permits

	(1)	(2)	(3)	(4)
Intercept (a_0)	-.1589	-1.1401	-.3699	-.6706
Income Elasticity (a_1)	-.0349 (.1308)	1.6785 (.3605)	.7446 (.1775)	.1600 (.3690)
Density Elasticity (a_2)	-.0789 (.0398)	.8666 (.1379)	.1287 (.0527)	.6308 (.1153)
Tax Coefficient (a_3)	.1227 (.0137)	.7096 (.0672)	.2870 (.0196)	.3083 (.0328)
Number of observations	1173	1468	1510	1213

The numbers in parentheses are standard errors.

(1) Residential Housekeeping Buildings (101,103,104,105)

(2) Nonresidential Buildings (318,320,321,322,324,327) and Residential Nonhousekeeping Buildings (213,214)

(3) Additions, Alterations and Conversions to Residential Buldings (434) and Additions to Residential Garages and Carports (438)

(4) Additions, Alterations and Conversions to Nonresidential Buildings (437)

Equation:

$$\ln\left(\frac{AV_{c,m,y}}{AV_{c,y}}\right) = a_0 + a_1 \ln\left(\frac{AI_{c,m,y}}{AI_{c,y}}\right) + a_2 \ln\left(\frac{AD_{c,m,y}}{AD_{c,y}}\right) + a_3\, ETD_{m,y} + \epsilon$$

(weighted by $\sqrt{\text{number of housing starts}}$ to adjust for heteroskedasticity, and corrected for autocorrelation)

Variables:

AV = average value of permits
AI = average income
AD = average density
ETD = effective tax differential

Subscripts:

c = category [1..4]
m = municipality
y = year

correlated with the incomes of persons who build houses. Another part of the explanation could be that the restriction of the set of cities to those that were comparable to the two-rate cities greatly reduced the range of average income, and therefore limited the ability of the analysis to estimate the income elasticity of value per house. But since the purpose of the analysis was to measure the response of average value to construction, and since the inclusion of an income range where there were no two-rate cities could have biased the analysis, the reduction in the range was justified despite the loss of an accurate estimate of income elasticity.

The density elasticities say that when density rises, people build somewhat less expensive houses, but substantially more expensive nonresidential buildings.

But the central result of the analysis concerns the coefficients for the effective tax differentials. The results say that for all four categories of construction, an increase in the effective tax differential is associated with an increase in the average value per permit. In the case of residential housing, a 1% increase in the effective tax differential is associated with a 12% increase in the average value per unit. For the category of nonresidential buildings and residential nonhouskeeping buildings, a 1% increase in the effective tax differential is associated with a 71% increase in the value per building. For residential additions, alterations, carports and garages, a 1% increase in the effective tax differential is associated with a 29% increase in the average value per permit. For additions, alterations and conversions to nonresidential buildings, a 1% increase in the effective tax differential is associated with a 31% increase in average value per permit. In all four of these cases, the standard errors of estimate of these coefficients are quite small. These results are therefore statistically highly significant.

From the perspective of economic theory, it is not at all surprising that when taxes are taken off of buildings, people build more valuable buildings. But it is nice to see the numbers.

Appendix A: Building Permits Survey Documentation

Description of Data Items

Residential Housekeeping Buildings (Item Numbers 101-105, 109, 434)

Item Type of Structures

101 Single Family Houses - Includes all detached one-family houses. Also includes all attached one-family houses separated by a wall that extends from ground to roof with no common heating system or interstructural public utilities. Includes prefabricated, sectionalized, panelized, and modular homes which are manufactured partially off-site, but which are transported and assembled at the construction site. Excludes mobile homes.

103 Two-Family Buildings - Includes all buildings containing two housing units which may be one above the other or side-by-side. If built side-by-side, they (1) do not have a wall that extends from ground to roof or (2) share a heating system, or (3) have interstructural public utilities such as water supply/sewage disposal.

104 Three- and Four-Family Buildings - Includes all buildings containing three or four housing units. If built side-by-side, they (1) do not have a wall that extends from ground to roof, or (2) share a heating system, or (3) have interstructural public utilities such as water supply/sewage disposal.

105 Five-or-More Family Buildings - Includes all buildings containing five or more housing units. If built side-by-side, they (1) do not have a wall that extends from ground to roof, or (2) share a heating system, or (3) have interstructural public utilities such as water supply/sewage disposal.

109 Total - A summarization of items 101 through 105.

434 Additions, Alterations, and Conversions to Residential Buildings - Includes all permits issued for additions and alterations to housekeeping residential buildings, and conversions of nonresidential and nonhousekeeping buildings to residential buildings. Does not include special "installation" permits issued to cover electrical, plumbing, heating, air-conditioning, or similar mechanical work. Also excludes the installation of fire escapes, elevators, signs, etc.

Additions of garages and carports are included in item 438.

Residential Nonhousekeeping Buildings (Item Numbers 213-214)

Item Type of Structures

213 Hotels, Motels, and Tourist Cabins Intended for Transient Accommodations - Includes hotels, motels, tourist cabins and apartment hotels intended for transient accommodations.

214 Other Nonhousekeeping Shelter - Includes lodge associations or club buildings with bedrooms, rooming houses, dormitories, fraternity houses, and similar nonhousekeeping residential buildings.

Nonresidential Buildings (Item Numbers 318-329, 437-438)

Item Type of Structures

318 Amusement, Social and Recreational Buildings - Includes buildings designed to provide amusement or recreation, such as: theaters, radio and TV studios, auditoriums, athletic and social clubs, YMCA buildings used primary for recreation, arenas, bowling alleys, skating rinks, bathhouses and gymnasiums.

319 Churches and Other Religious Buildings - Includes churches, temples, synagogues, parish halls, Sunday school rooms, monasteries, and convents.

320 Industrial Buildings - Includes plants producing, processing, or assembling goods and materials, such as factories, machine shops, paper mills, beverage plants, manufacturing plants and printing plants.

321 Parking Garages (Buildings and Open Decked) - Includes garage buildings and open-deck parking structures to be used primarily for transient parking. Does not include storage garages which are reported in item 328.

Parking lots are out of the scope of this survey.

322 Service Stations and Repair Garages - Includes service stations and repair garages.

323 Hospitals and Institutional Buildings - Includes hospitals, convalescent homes, rest homes, homes for the aged, nursing homes, orphanages, and similar establishments for prolonged institutional care. Does not include doctors' offices which are included in item 324, or staff houses and apartments which are included in items 101 through 105.

324 Office, Bank, and Professional Buildings - Includes offices, banks, professional buildings, financial institutions, administration buildings and medical office buildings.

325 Public Works and Utilities Buildings - Includes buildings providing public services such as: transportation, communications, power, light, heat, sewage and garbage disposal, trash incineration, and water supply.

326 Schools and Other Educational Buildings - Includes buildings such as schools, libraries, museums, observatories, universities and academies. Does not include faculty and student apartments which are included in items 101 through 105.

327 Stores and Customer Services - Includes buildings used in buying, selling, distributing, or storing of merchandise and materials, or performing customer services such as: stores, auto and other showrooms, warehouses, grain elevators, restaurants, taverns, night clubs, bakery shops, laundry and dry cleaning shops, laundromats, beauty and barber shops and kennels.

328 Other Nonresidential Buildings - Includes buildings such as: sheds, boat houses, barns, silos, dog pounds, post offices, storage garages, animal hospitals, jails and reformatories.

Include all other nonresidential buildings not elsewhere classified.

329 Structures Other Than Buildings - Includes non-building recreational facility construction and harbor and port facility construction such as: outdoor swimming pools, marinas, outdoor stadiums, parks, outdoor theaters, boardwalks, wharves and docks.

437 Additions, Alterations and Conversions - Nonresidential and Nonhousekeeping - Includes additions, alterations and conversions to nonresidential and nonhousekeeping residential buildings, and conversions of housekeeping buildings to nonresidential or nonhousekeeping residential buildings. Does not include special "installation" permits issued to cover electrical, plumbing, heating, air-conditioning, or similar mechanical work. Also excludes the installation of fire escapes, elevators, signs, etc., and conversions to residential housekeeping buildings.

438 Additions of Residential Garages and Carports - Includes additions of new residential garages and carports whether attached or detached. Does not include those included in items 101 through 105. Item number 436 was used through 1985.

Demolition and Razing of Buildings (Item Numbers 645-649)

Item Type of Structures

645 One-Family Homes - Includes all detached and attached one-family houses

646 Two-Family Buildings - Includes all buildings containing two housing units which may be one above the other or side-by-side.

647 Three- and Four-Family Buildings - Includes all buildings containing three or four housing units.

648 Five-or-More Family Buildings - Includes all buildings containing five or more housing units.

649 All Other Buildings and Structures - Includes all nonhousekeeping buildings and nonresidential buildings.