ON THE POLITICAL ECONOMY OF TAX LIMITS

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ABSTRACT

We study the political economy of state limitations on the taxing powers of local governments, investigating the effects of such restriction on housing markets, community composition, and types of taxes and expenditures undertaken by local governments. We characterize equilibrium when voters choose values of multiple policy (tax and expenditure) instruments, finding that tax limitations have very substantial effects on housing prices and the composition of communities. Household relocation following introduction of tax limits results in an increase in median incomes in all communities. The electorates of communities then adopt policies quite different from those that prevail in the absence of tax limitations, reducing expenditures on redistribution while preserving or increasing per capita expenditures on public good provision. Political support for tax limits comes from suburban voters and from a subset of central-city voters who benefit from increased public service expenditures and reduced deadweight losses in housing markets. These results accord well with the hypothesis of Vigdor (2001)—that much political support for tax limits comes from a desire by individuals to limit taxes in localities other than their own. Our model permits characterization of voting equilibrium when there are multiple policy instruments and provides a novel application of the Besley and Coate (1997) model of representative democracy.

1. Introduction

States impose many restrictions on the taxing powers of local governments. Best known are the property tax limits imposed by popular referenda in California and Massachusetts. These are only the tip of the iceberg, however. Forty-six of the states place some form of restriction on local property taxes, with more than half setting a limit on the property tax rate that municipalities may impose.[1] In addition to setting upper limits on local tax rates, states also limit the instruments that localities are permitted to use. Local governments are creatures of state governments and may use only tax instruments authorized by their state governments. For instance, in most states, local governments are required to have authorization from the state legislature to impose an income or payroll tax. That authorization usually dictates the form of the tax, the permissible range of rates, and the treatment of non-residents. Only 16 states authorize some form of local income taxes, and only 8 have any municipalities that impose income taxes.[2]

We study the political economy of state limitations on the taxing powers of local governments, investigating the effects of such restriction on housing markets, community composition, and the types of expenditures undertaken by local governments. We find that tax limitations have very substantial effects on housing prices and the composition of communities. Adjustments following introduction of tax limits result in an increase in median incomes in all communities. The electorates of communities then adopt policies quite different from those that prevail in the absence of tax limitations. Tax limits thereby have striking effects on spending, reducing expenditures on redistribution but,

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[1] Advisory Commission on Intergovernmental Relations, 1995(a), p. 23.

[2] Advisory Commission on Intergovernmental Relations, 1988, and 1995(b), Table 20, pg. 70.

surprisingly, increasing per capita expenditures on public good provision in all communities.

One objective or analysis is to investigate political support for tax limitations. It is clear that, in practice, limitations are by no means counter to the wishes of voters. Voter-supported initiatives such as Proposition 13 in California and Proposition 2 ½ in Massachusetts attest to the popularity of tax limits. This raises an apparent puzzle. Why would voters support a state referendum to limit their local government's taxing powers? One would expect local governments to be most responsive to voters, being the governments that are "closest to the people." Our results provide support for a fundamental insight of Vigdor (2001). He offers the hypothesis that support for local tax limits comes not from voters wishing to limit the taxes their own locality imposes, but rather from the desire of voters to limit tax rates in localities in which they do not reside. He observes that voters in one locality may wish to limit the tax rate in another locality because they would prefer to live in that locality if the tax rate there were lower. He presents a model with three voter types in which this motive for limiting state taxes leads to adoption of state tax limits.[3]

We find in our model that two sets of voters support tax limitations. Some who support the limit will move if the limit is adopted. Others who do not anticipate relocating to another municipality also support tax limits. The reason traces to the distortionary effects of high central-city taxes emphasized by Mieszkowski and Mills (1993). Tax limits have greatest bite in the central-city, where our model predicts that taxes will otherwise be highest. Through reductions in the distortionary effects of central-city taxes, suburban

[3] Other factors may play an key role as well. See Fishel (1989) and O'Sullivan, et. al. (1995) for alternative explanations for the popularity of California's Proposition 13.

residents benefit from tax limits. Tax limits cause net-of-tax housing prices to rise and gross-of-tax housing prices to fall in the city and in the lower-income suburbs that are the closest substitutes for the city. In wealthier suburbs that are less close substitutes for the cities, property values fall. Despite this, most residents of those suburbs are better off with the tax limits. Lower housing prices permit them to expand housing consumption, and the out-migration of lower-income households permits remaining residents to increase public good consumption per capita without increasing taxes. These latter two effects offset the capital loss that those homeowners experience.

Our analysis shows that, for understanding the effects of tax limits, it is essential to consider both public-good expenditures and redistributive expenditures. In addition, to understand limitations on the set of tax instruments that municipalities are permitted to use, it is clearly necessary to consider more than one tax instrument. Study of the political economy of tax and expenditure structure has been severely hampered by the well-known problem of potential non-existence of equilibrium when voting is over multidimensional choices (Plott, 1967). Thus, the preponderance of work on modeling tax and expenditures presumes use of a given tax instrument and a given form of expenditure. The voting problem is then reduced to a single dimension by imposition of the government budget constraint. While this approach has led to a rich body of research,[4] it is too restrictive to permit study of choice among tax instruments and forms of expenditures. Research studying higher-dimensional voting problems typically assumes that voters consider only a restricted set of choices on any given vote, with

[4] See, for example, Westhoff, 1977, Goodspeed, 1989, Epple, Filimon, and Romer, 1984, Ellickson, 1982, Fernandez and Rogerson, 1996 and 1998, Calabrese, 2001, Epple and Romano, 2003.

issues decided by multiple votes.[5] It is increasingly difficult, however, to apply this approach as the dimensionality of voting problems increases—because arbitrary choices must then be made about which tradeoffs that are considered on a given vote. The approach thus raises the concern that results may be sensitive to the tradeoffs that voters are presumed to consider when voting on a particular issue.

A contribution of our work is study of choice of tax instruments in a framework in which voting equilibrium exists when voters consider all issues simultaneously. In particular, we adopt a preference structure, consistent with empirical evidence on demand functions, for which equilibrium exists. We study the equilibrium among local jurisdictions that emerges when localities are permitted use of two or more tax instruments. We then investigate whether there will be majority support for state-level restrictions on local taxes, and we investigate the equilibrium that emerges when tax limits are imposed. While our primary focus is positive analysis of tax limits, we also undertake a welfare analysis of limits, finding that a large proportion of the population gains from imposition of tax limits. The reduction in redistributive expenditure that follows adoption of tax limits reduces the welfare of the lowest-income households. We find, however, that a relatively modest increase in redistribution at the state level can offset the welfare loss experienced by low-income households. Thus, tax limits coupled with a modest increase in state aid to the poorest households can be Pareto improving.

[5] Reducing the problem to a single dimension does not assure existence of voting equilibrium (Denzau and MacKay, 1981), but does permit use of familiar strategies for imposing conditions on model structure such that equilibrium exists. Nechyba (1997) provides a creative application of this approach, allowing separate votes over local and state tax rates. At the local level, where both income and property taxes may potentially be used, Nechyba gives a community planner responsibility for setting one instrument while voters choose the value of the other.

As explained above, the distortionary effects of central-city taxes that arise in the absence of tax limits play an important role in our analysis. Before turning to that analysis, it is useful to cite a particular instance. Prior to the imposition of proposition 2 ½ in Massachusetts, the residential property tax rate in Boston was approximately 6.3% of property value. In thinking about the magnitude of this tax, it is useful to convert this value to a rate applied to the annual rental of housing services. If we convert property values to annualized flow using rates on the order of 7% to 9%,[6] the implied tax rate on annualized service flow is on the order of 70% (=6.3/.09) to 90%. Relative to sales tax rates typically observed on other commodities, this is an exceedingly high rate. In our model, we find a central-city tax rate of 61.2% on annualized service when there is not a property tax limit and local income tax is not used. This comparison suggests that, if anything, our computational model tends to understate central-city tax rates and the attendant political support for tax limits.

2. Model and Properties

The economy of the model consists of a continuum of households that differ only in their endowed income y.[7] The distribution of income is represented by the continuous distribution f(y). All households have the same preferences represented by utility function U(g,h,b), where g is expenditures on a publicly provided good, h is units of housing, and b is consumption of a numeraire bundle. We first develop properties of

[6] The user cost of housing net of property taxes (Poterba, 1992) is $(1-t_y)i+\zeta$ where t_y is the income tax rate, i is the nominal interest rate, and ζ is the sum of the risk premium on housing investments, maintenance, depreciation, and inflation. Let t_y=.15 and, following Poterba, let ζ=-.02 and i=.1286. The result is a rate of 8.9% for converting property value to implicit net-of-property-tax rental rates. Using an income tax rate of .25, we obtain a rate of 7.5%. These calculations suggest conversion rates on the order of 7% to 9%.

[7] Assuming a single dimension of heterogeneity is restrictive. However, this simplification yields major benefits from the perspective of tractability while providing valuable insights about the effects of tax limits.

equilibrium for the case in which all households are renters. We then extend the results to the case of owner-occupants.

There are multiple local communities that may differ in land area. Each has a local government that may impose a proportional income tax, m, on the income of its residents, and an ad valorem property tax, t, on the value of housing in the jurisdiction. Total tax revenue in each community may be used to finance expenditures on a publicly provided good, g, and a lump sum redistributive grant, r, to each individual in the community. The tax rates, m and t, and expenditure levels, g and r, are determined by majority vote of residents of the locality. Voting is conducted simultaneously on this set of variables.[8]

A household with income y faces the following budget constraint if the household locates in a particular community, j:

$$y(1-m^j)+r^j = p^j h + b$$

The gross-of-tax price per unit of housing is, p^j. We denote the net-of-tax price p_h^j. The following identity relates the gross- and net-of-tax prices: $p^j \equiv p_h^j(1+t^j)$. A household locates in the community with the tax/expenditure policy for which the household obtains the highest utility.

We adopt the following functional form for utility:

$$U(g,h,b) = v(g)[u(h,b)+\phi]$$

We assume that u(h,b) is homogeneous of degree 1. This assumption is consistent with the empirical evidence on housing demand (Harmon, 1988), which suggests that the

[8] While municipalities do not literally give cash grants to local residents, they do provide a variety of services to aid the poor. Inman (1995) identifies increasing poverty-related spending as the major source of increased per capita expenditure on goods, services and supplies over the period from 1973 to the onset of Philadelphia's financial crisis in 1990. Inman (1989) also emphasizes the importance of redistributive politics as a determinant of tax policy in his study of 41 U.S cities over the period from 1961 to 1986.

income elasticity of housing demand is approximately one. Linear homogeneity of u(h,b) implies that the corresponding indirect utility function is linear in income, a property that will prove central in our analysis of voting equilibrium:

$$V(y) = v(g)[(y(1-m)+r)w(p)+\phi] \qquad (1)$$

Turning to supply, we assume that housing is produced by price-taking firms in each jurisdiction from land and non-land factors via a constant-returns neoclassical production function. The price of non-land factors is assumed fixed and uniform throughout the metropolitan area. The housing supply function in community j can then be represented by $H_s^j(p_h^j) = L^j h_s(p_h^j)$ where $h_s(p_h^j)$ is housing per unit of land in community j and L^j is land area in community j, C^j. When $u(h,b)$ is homogeneous of degree 1, household y's housing demand in C^j can be represented by $(y(1-m^j)+r^j)h_d(p^j)$. Housing market equilibrium in C^j then requires the following, where $p_h^j = p^j/(1+t^j)$:

$$h_d(p^j)\int_{y\in C^j}(y^j(1-m^j)+r^j)f(y)dy = L^j h_s(p_h^j) \qquad (2)$$

Equilibrium is an allocation of households across communities such that:

1. Within each community:

    a) the housing market clears

    b) the government's budget is balanced

    c) majority rule determines the government's policy (t, m, r, g)

2. Each community is occupied, and no one wants to move.

The first part of the definition of equilibrium above specifies conditions for *internal equilibrium*. This together with the second condition specifies conditions for *intercommunity equilibrium.* We develop conditions that must be satisfied for an allocation to be an equilibrium. In our computational analysis, we then verify an allocation is an equilibrium by checking that the conditions for equilibrium are satisfied. We develop necessary conditions for *intercommunity equilibrium*. We then characterize Majority Voting Equilibrium, demonstrating that the median-income voter in each community is pivotal in determining that community's policy choices.

2.1 Intercommunity Equilibrium

Proposition 1 presents conditions characterizing intercommunity equilibrium.

Proposition 1: *Consider an allocation in which all communities are occupied. If*

$$\frac{r^j w(p^j)+\phi}{(1-m^j)w(p^j)} \neq \frac{r^k w(p^k)+\phi}{(1-m^k)w(p^k)} \quad \forall \quad i \neq j, \tag{3}$$

Intercommunity equilibrium is characterized by:[9]

a) **Income Stratification Among Communities:** *Each community contains households with incomes in a single interval.*

b) **Boundary Indifference:** *Order communities from lowest to highest income levels. Between each pair of adjacent communities in this ordering is a household that is indifferent between the two communities.*

c) **Ascending Bundles:** *Incomes ascend across communities in the same order as* $v(g^j)(1-m^j)w(p^j)$.

Proof: Choose any pair of communities, C^j and C^k. Using equation (1), the difference in utility between communities C^j and C^k for a household with income y is:

$$\Delta V(y) = v(g^j)[(y(1-m^j)+r^j)w(p^j)+\phi] - v(g^k)[(y(1-m^k)+r^k)w(p^k)+\phi] \tag{4}$$

[9] Proof of this proposition builds on the approach developed in Calabrese (2001).

$\Delta V(y)$ cannot be strictly positive for all y. This would imply that all households prefer C^j, contradicting the assumption that all communities are occupied. Similarly, $\Delta V(y)$ cannot be strictly negative for all y, since all would then prefer C^k.

We next demonstrate that not all households are indifferent between communities. To form a contradiction, suppose all households are indifferent. This implies that $\Delta V(y) = 0 \;\forall\; y$, and hence that ΔV(y) has both intercept and slope equal to zero:

$$\Delta V(0) = 0 \Rightarrow \quad v(g^j)[r^j w(p^j) + \phi] = f(g^k)[r^k w(p^k) + \phi] \tag{5}$$

$$\frac{\partial \Delta V(y)}{\partial y} = 0 \Rightarrow v(g^j)(1-m^j)w(p^j) = v(g^k)(1-m^k)w(p^k) \tag{6}$$

Dividing the above, we obtain $\frac{r^j w(p^j) + \phi}{(1-m^j)w(p^j)} = \frac{r^k w(p^k) + \phi}{(1-m^k)w(p^k)}$, which contradicts (3).

The preceding results coupled with the linearity of *ΔV(y)* imply that there exists a unique $\hat{y} > 0$ for which $\Delta V(\hat{y}) = 0$. This establishes part (b) of the proposition. If *ΔV(y)* is downward sloping, all $y < \hat{y}$ prefer community j and all $y > \hat{y}$ prefer community k. The reverse is true if *ΔV(y)* is upward sloping. This establishes part (a). If communities are arrayed by ascending values of $v(g^j)(1-m^j)w(p^j)$, then *ΔV(y)* is downward sloping, establishing part (c). ■

Remark: As income rises, the demand for g rises, and the dollar cost of an income tax also rises. In addition, as income rises, the demand for housing rises, causing the dollar cost of an increase in the unit price of housing to rise with income. The expression $v(g^j)(1-m^j)w(p^j)$ impounds the effects of changes in the three variables (g,m,p) into a single term that is valued increasingly highly as income rises.

When $\phi<0$, our preference function satisfies the usual single crossing condition that the slope of indifference curves in the (g,p) plane increases with income. This condition plays an important role in characterizing stratification across communities when there is only one tax instrument and one type of public expenditure. As will be evident below, the conditions for stratification in Proposition 1 are met in our computed equilibrium even with $\phi = 0$. Thus, henceforth, we simplify by considering the indirect utility function in (1) with $\phi = 0$. When $\phi = 0$, homothecity of u(h,b) is sufficient for all propositions in this paper; homogeneity of degree one is not required.

The value of the indirect utility function at y = 0 and its slope with respect to y are:

$$V(0) = v(g^j)r^j w(p^j)$$

$$\frac{\partial V(y)}{\partial y} = v(g^j)(1-m^j)w(p^j)$$

Consider any two communities, C^j and C^k satisfying Equation (3), with average incomes $\bar{y}^j$ and $\bar{y}^k$ respectively, $\bar{y}^j < \bar{y}^k$. Hence, the intercept for $V^j(y)$ must be greater than for $V^k(y)$, and the slope less. These conditions imply Equations (7) and (8) below.

$$v(g^j)r^j w(p^j) > v(g^k)r^k w(p^k) \tag{7}$$

$$v(g^j)(1-m^j)w(p^j) < v(g^k)(1-m^k)w(p^k) \tag{8}$$

We first develop the intercommunity equilibrium conditions when it is assumed local communities do not employ income tax to generate revenue. We then consider the equilibrium conditions when income tax is included in the model.

2.1.1 Intercommunity Equilibrium Conditions without Income Tax

Proposition 2: *Assume local communities do not employ income tax as a revenue-generating instrument. The following conditions are necessary for an allocation to be an Intercommunity Equilibrium:*

- **i)** **Descending lump-sum grants.** The grant level is decreasing in average community income, i.e. $\bar{y}^j < \bar{y}^k \Rightarrow r^j \geq r^k$.
- **ii)** If $g^j > g^k$ then $p^j > p^k$.
- **iii)** If $p^j < p^k$ then $g^j < g^k$, and if $p^j = p^k$ then $g^j \leq g^k$.

Proof: If local communities can only employ property taxes, then equation (8) becomes:

$$v(g^j)w(p^j) < v(g^k)w(p^k) \tag{9}$$

Part (i) follows from (7) and (9), while (ii) and (iii) follow from (9).■

Condition (i) accords well with intuition—low-income households migrate to the community with the highest level of redistribution. If community j also offers higher public good provision, then clearly the price must be higher in j, as stated in (ii). Alternatively, if the price in j is lower than in k, then public good provision must be lower in j than in k. Note that the above conditions do not rule out the possibility that the price in j is higher than in k and public provision in j is lower than in k. This can happen, for example, if the redistributive grant is substantially higher in j than in k.

2.1.2 Intercommunity Equilibrium Conditions with Income Tax

When states permit localities to employ an income tax, we have:

Proposition 3: *Assume local communities are able to employ a proportional income tax as a revenue-generating instrument. Suppose WLOG that* $\bar{y}^j < \bar{y}^k$. *The following relationships are implied by Intercommunity Equilibrium:*

i) If $m^j < m^k$

a) then $r^j > r^k$.

b) and if $g^j \geq g^k$ then $p^j > p^k$.

c) and if $p^k \geq p^j$ then $g^k > g^j$.

ii) If $r^j < r^k$

a) then $m^j > m^k$.

b) and if $g^k \geq g^j$ then $p^j < p^k$.

c) and if $p^j \geq p^k$ then $g^j > g^k$.

Proof: Parts (ia) and (iia) follow from equations (7) and (8). Parts (ib) and (ic) follow from (8). Parts (iib) and (iic) follow from (7).■

We expect that it will generally be the case that the poorer of a pair of communities will have both a higher income tax rate and a higher level of redistribution. However, this need not always be the case. The conditions in Proposition 3 characterize restrictions on allocations in cases in which the income tax rate and the per capita grant do not have the same order. Condition (i) of Proposition 3 states that a community with a relatively low income tax rate may be occupied by poor households if the community offers a relatively high per capita grant. In this case, the higher-income households may prefer the community with the higher income tax rate if the level of government services is higher and/or the housing price is lower. Proposition 3 (ii) provides the conditions for a very unlikely equilibrium allocation in which the grant is lower and the income tax rate is higher in the low income community. An allocation satisfying these conditions can be an equilibrium only if public good provision is extremely high and/or the price of housing is extremely low in the poor community relative to the wealthy community.

2.2 Internal Equilibrium

Recall that the conditions for internal equilibrium are that, in each community: the housing market clears, the government's budget is balanced, and there is a majority-rule equilibrium determining tax and expenditure policy.

We define this set of all possible (t, m, r, g) combinations for community j as the *Budget Possibility Frontier* (BPF). The characterization of this frontier is detailed further below.

For a given community, a point (t^*, m^*, r^*, g^*) is a *Majority Voting Equilibrium* (MVE) if it is on the community's BPF and there is no point on the BPF strictly preferred to (t^*, m^*, r^*, g^*) by a majority of the community's residents.

Proposition 4: The *Majority Voting Equilibrium* in a community is the outcome on the *Budget Possibility Frontier* most preferred by the community's median-income voter.[10]

Proof: Let x^* = (g^*, m^*, r^*, p^*) denote the point most preferred by the median income voter, $\tilde{y}$. To form a contradiction suppose there exists a point x = (g, m, r, p) that defeats x^*. Let $\Delta V(y)$ be the difference in utility that voter y obtains between x^* and x:

$$\Delta V(y) = v(g^*)(y(1-m^*)+r^*)w(p^*) - v(g)(y(1-m)+r)w(p) \tag{10}$$

It cannot be the case that $\Delta V(y) < 0$ for all y. This would contradict the assumption that x^* is the point most preferred by the median-income voter. Alternatively, if $\Delta V(y) > 0$ for all y, then x^* is unanimously preferred to x. If all voters are indifferent between x^* and x (i.e., $\Delta V(y) = 0$ for all y), then we adopt the convention that x^* is chosen.

This leaves cases where some voters strictly prefer x^* to x while others strictly prefer x to x^*. For these cases, the linearity of $\Delta V(y)$ implies that there is a unique $\hat{y}$ such that

[10] The strategy of proof of this proposition is due to Cassidy (1990) who exploits the linearity of the indirect utility function in income to study voting equilibrium in a model with a flat grant financed by a property tax.

$\Delta V(\hat{y}) = 0$. There are two possibilities. One is that voters preferring x to x^* have incomes less that $\hat{y}$. If x defeats x^*, these voters comprise more than half the population. This implies $\tilde{y} < \hat{y}$ which in turn implies that $\tilde{y}$ prefers x to x^*. This is a contradiction since x^* is $\tilde{y}$'s most preferred outcome. The other alternative is that voters with income greater than $\hat{y}$ prefer x to x^*. Since x defeats x^*, these voters comprise more than half the population. This implies $\tilde{y} > \hat{y}$ which implies that $\tilde{y}$ prefers x to x^*. This is again a contradiction since $\tilde{y}$ prefers x^* to x.[11] ■

Completing characterization of intra-community equilibrium requires characterizing the community Budget Possibility Frontier. This in turn requires a characterization of voters' perceptions of how the private-market equilibrium in the community will be affected by public policy choices. The latter is needed for two reasons. Voter perceptions of how the private market outcomes depend on policy affect their perceptions of the population to be served and the tax base. In addition, voter utility depends on how they expect policy changes to affect the price of housing.

There are many possible ways to characterize the BPF, depending on the degree of voter sophistication in anticipating the consequences of policy changes within a community. Our characterization of voting behavior draws on modern club theory and assumes that individuals are utility takers.[12] This means voters assume that the policy tuples (t, m, r, g) and housing prices in all the other communities are fixed. Employing this utility-taking assumption, voters predict how the private market equilibrium would change in response to a prospective policy change. For example, a voter assumes the price of housing in

[11] This proposition implies that the well-known Plott (1967) conditions hold for our model.
[12] As explained in Epple and Romer (1991, p. 837), the assumption of myopic voting over redistributive expenditures is untenable; in communities with median income less than the mean, myopic voters would attempt to expropriate and redistribute the entire property tax base.

his/her community is affected by changes in the government's budget through both changes in housing demand by current residents and migration into or out of the community, taking as given policies and prices in other communities.

The income stratification result in Proposition 1 and community budget balance imply:

$$t^j p_h^j h_d(p^j)(\bar{y}^j(1-m^j)+r^j)+m^j\bar{y}^j = r^j + g^j \quad \forall j \tag{12}$$

The possible (t, m, r, g) combinations for community j given (t^{-j}, m^{-j}, r^{-j}, g^{-j}) then satisfy housing market clearance and budget balance in community j (Equations 2 and 12), and the stratification and boundary-indifference conditions of Proposition 1.

2.3 Owner Occupants

Thus far, we have treated all of a jurisdiction's residents as renters. Suppose, by contrast, that all residents are owner-occupants who locate in a jurisdiction and purchase housing there before participating in the voting process that determines the structure of the jurisdiction's budget. [13] There are no transactions costs in the purchase and sale of housing. As in the preceding model with rental housing, households anticipate how their housing consumption will change in response to a change in the price of housing induced by a change in the structure of the jurisdiction's tax-expenditure policies. Households also anticipate the capital gain or loss they will incur if their jurisdiction's tax-expenditure policy is changed, resulting is a change in the net-of-tax price of housing.

Let h_o be the amount of housing purchased at price $p_{h,o}$ by a household with endowed income y. When making decisions about whether to change its consumption bundle, the household faces the budget constraint $(1-m)y+r+(p_h-p_{h,o})h_o = ph+b$ with h_o and $p_{h,o}$ fixed. The third term on the left-hand side is the capital gain or loss from selling the

[13] Our formulation of the preferences of owners builds on the approach of Epple and Romer (1991).

household's existing dwelling. Given linear homogeneity of the utility function in housing and numeraire consumption, the housing demand function is then of the form $h = (y(1-m) + r + (p_h - p_{h,o})h_o)h_d(p)$. Substituting this function into both the budget constraint and the utility function, we obtain the indirect utility function:

$$V(y) = v(g)(y(1-m) + r + (p_h - p_{h,o})h_o)w(p),$$

The housing demand function for a consumer with income y given (p_o, r_o, g_o, m_o, $p_{h,o}$) is:

$$h(p_o, y(1-m_o) + r_o) = (y(1-m_o) + r_o)h_d(p_o)$$

Consider an owner with income y who purchased at (p_o, r_o, g_o, m_o, $p_{h,o}$). When voting, such an owner may contemplate voting for a change in tax-expenditure policy that would cause prices, taxes, and expenditures to change to (p, r, g, m, p_h). If such a change were to occur, the owner's utility at (p, r, g, m, p_h) would be:

$$V(y) = v(g)(y(1-m) + r + (p_h - p_{h,o})((y(1-m_o) + r_o)h_d(p_o))w(p) \qquad (13)$$

Thus, when voting, owner y will vote for a change to (p, r, g, m, p_h) if the utility given in (13) is higher than it would be if the policy were unchanged and prices and tax-expenditure policy remained at (p_o, r_o, g_o, m_o, $p_{h,o}$). While renters care only about (p, r, g, m), it is clear from (13) that owners care about p_h as well.

Equation (13) is linear in household income, y. This property of owners' utility functions can be used in a straightforward fashion to extend Proposition 4 to the case where all households are owners. That is, the majority voting outcome when all households in a community are owners is the point (p^*, r^*, g^*, m^*, p_h^*) that maximizes the utility of the owners with median income.

We assume that all transactions occur in equilibrium. Thus, in equilibrium, households make transactions at (p_o, r_o, g_o, m_o, $p_{h,o}$) = (p, r, g, m, p_h), and the majority voting outcome does not lead to a departure from (p, r, g, m, p_h). Note that equation (13) reduces to equation (1) when (p_o, r_o, g_o, m_o, $p_{h,o}$) = (p, r, g, m, p_h). It follows that Propositions 1 through 4 of the renters case continue to hold in the owners case. Thus, necessary conditions for equilibrium in the owners' model are the same as in the renters' model.

While Propositions 1 through 4 apply in the owner's case as they do in the renter's case, the equilibrium with owners will generally differ from that with renters. The reason is as follows. A change in a jurisdiction's tax-expenditure policy will, in general, change the net-of-tax price of housing. Since owners make their purchase decisions before voting, they experience a capital gain or loss if they vote for a policy change. Thus, as detailed in (13), their utility will be affected by the change in the net-of-tax price of housing. Renters, by contrast, are indifferent to changes in the net-of-tax price. This leads to differences in equilibrium outcomes when voters are renters than when voters are owners.

2.5. Equilibrium with Both Renters and Owner-Occupants

We now extend the model to the case in which some households choose to be owner-occupants while others choose to rent. Let $\rho(y)$ be the proportion of metropolitan residents with income y who are renters. Since transactions occur only in equilibrium, choice of jurisdiction is not affected by whether the household will own or rent. Thus, Propositions 1 through 3 hold when there are both owners and renters.

By contrast, there is no extension of Proposition 4 to the case with both owners and renters that preserves the generality of the result. The multi-dimensional nature of the set of alternatives underlies the lack of generality. To resolve this existence issue, we adopt an idealized city-council model. We believe this city-council model to be well motivated from an institutional point of view and an illuminating way to characterize the majority outcome with both owners and renters. We assume that, within a community, households sort into neighborhoods based on income. Neighborhoods are single-member districts, and each sends a representative to city-council. There are a large enough number of districts that, within districts, income heterogeneity is negligible.[14] Thus, within a neighborhood, the only difference in preferences arises because some own and others rent. The council member serves his/her own interests, which are also the interests of the type in the majority in his/her council district. In a neighborhood with income y, the councilperson is a renter if $\rho(y) > .5$ and an owner-occupant if $\rho(y) < .5$.

The composition of the council will be as follows. Let y_l and y_h be the lower and upper income boundaries of the community. The income distribution of the council will be a replica of the population income distribution, f(y), in the interval $[y_l,y_h]$. The median-income member of the council will have the median income of the community. Let y_c solve $\rho(y_c)=.5$. All council members with incomes less than y_c will be renters and all with incomes greater than y_c will be owners. Hence, the council member with median income, $\tilde{y}$, will be a renter if $\tilde{y} < y_c$ and an owner if $\tilde{y} > y_c$.

We assume that the council in turn elects a member to implement its policy. Members cannot make binding commitments. Hence, the elected member will implement his or her most preferred policy. Our city-council thus functions under precisely the same terms as the citizenry in Besley and Coate's (1997) model of representative democracy.[15] We show in our computational model that the most-preferred policy of the median income council member is a Condorcet winner among the set of council member ideal points. If

[14] Operationally, we assume a continuum of districts.
[15] We are indebted to Richard Romano for suggesting this approach.

follows from Besley and Coate (Proposition 2, Corollary 1) that the policy of the median-income council member is adopted.

3. Computational Model

Development of more specific implications about the features of equilibrium requires more specific information about preferences, technology, the distributions of income and housing tenure, the number of jurisdictions and the land area of each. We therefore turn to numerical computations based on the theoretical model above to illuminate properties of the model. The parameterization utilizes functional forms and parameter values that are broadly consistent with empirical evidence on housing supply and demand functions, government expenditures, and the distribution of income in the U.S. We choose the following Cobb-Douglas utility function:

$$U(g,h,b) = g^{\beta} h^{\alpha} b^{1-\alpha} \tag{14}$$

We chose values for α and β such that, if g, h, and b were all privately purchased goods, the gross-of-tax expenditure on housing would be 1/3 and the fraction spent on local public goods would be 10%.[16] This yields $\alpha = .37$ and $\beta = .111$.

We adopt the following constant-elasticity of housing supply function, which is implied by a constant-returns Cobb-Douglas housing production function:

$$H_s^j(p^j) = L^j (p^j)^{\mu} \tag{15}$$

where L^j is the land area of community j as a proportion of total land area in the economy, and μ is the ratio of non-land to land inputs in the production of housing. Based on available evidence regarding the share of land and non-land inputs in housing (Epple and Romer, 1991), this parameter is set equal to three.

[16] We adopt and extend the approaches to calibration in Epple and Romer (1991) and Calabrese, Cassidy, and Epple (2002).

The distribution of income is calibrated using data from the 1999 American Housing Survey (AHS).[17] Median income reported by the AHS is $36,942. Using data for the 14 income classes reported by the AHS, we estimate mean income to be to $54,710. These and the assumption that the income distribution is lognormal imply lny ~ N(.886,10.52).

For the mixed owners-renters, we use the following function to characterize the fraction of renters at each income level:

$$\rho(y) = \begin{cases} \gamma y^{-\delta} & \text{for } y > \gamma^{1/\delta} \\ 1 & \text{for } y \le \gamma^{1/\delta} \end{cases} \tag{16}$$

The AHS data cited above present the number of renter- and owner-occupied housing units in the different income classes. We computed average income, $\bar{Y}$, in each income class, using the lognormal distribution of household income presented above. Regressing the log of the proportion of households who are renters, $\bar{\rho}$, against the log of $\bar{Y}$ gives estimates of γ and δ. The resulting regression, with t-statistics in parentheses is:

$$\begin{aligned} \ln \bar{\rho} = 8.35 - &.91 \times \ln \bar{Y}, \qquad R^2 = .93 \\ (9.1) \quad &(10.5) \end{aligned} \tag{17}$$

This equation implies γ=exp(8.35)=4215, δ=.91.[18]

We consider a metropolitan area with five local jurisdictions—a large city and four smaller suburbs that have equal land area. The city has 40% of the total metropolitan land area and each of the suburbs has 15% of the land area. We assume that the city is the poorest jurisdiction. These conditions for income stratification (Proposition 1) are satisfied in all computational results reported below.

[17] http://www.census.gov/hhes/www/housing/ahs/99dtchrt/tab2-12.html

[18] In estimating this equation, we drop the highest and the three lowest income categories. The estimated function is used to calculate the income at which the fraction of households switches from being majority renter to being majority of owner occupant. Thus, fit in the interior of the income distribution is of .

We impose minimal *a priori* constraints on tax structures, as follows. We constrain the income tax rate in the highest-income community to be zero. This reflects the reality that the richest individuals have the ability to relocate to avoid income taxation, moving, if necessary, to tax havens elsewhere in the country or even elsewhere in the world. In addition, we require that income and property tax rates be non-negative and that the income tax rates be no greater than one. We permit r to be either positive or negative in the suburbs. Negative values of r correspond to head taxes while positive values correspond to a flat grant. Head taxes are generally not used in practice. However, it has been shown by Hamilton (1975) that, when communities are small and internally homogeneous, zoning constraints that impose a lower bound on housing consumption have the effect of turning the property tax into a head tax. While our suburban communities are not the infinitesimal size assumed by Hamilton, we approximate by assuming that zoning constraints permit communities to effectively convert property taxes into head taxes. In the central-city, r must be non-negative due to feasibility constraints. The support of the income distribution is the positive real line; a head tax would violate the budget constraint of the poorest households.

3.2 Equilibrium when All Households are Renters

When local tax rates are not constrained by the state, equilibrium outcomes in the all-renters economy are reported in column 1 of Table 1. Consider first the results for community 1 (C^1). C^1 chooses a property tax rate of .33. As we noted above, property tax rates in our model are expressed as a proportion of the annualized implicit rental value of housing services. As we noted in the introduction, observed property taxes are expressed as a proportion of the market value of housing, not on the annual value of services. Using the 9% rate discussed in footnote 6, the 33% rate on annual implicit rent for C^1 in column (1) is equivalent to a tax rate on property value of 3% ($\cong$ 0.09 x 0.33). In addition to the property tax, C^1 also imposes an income tax at rate 12.4%. The revenues from the property and income taxes generate a total of $3,981 per capita. These revenues are allocated to provide public services of $2,021 per capita and a flat grant of $1,960 per capita. Thus, in this equilibrium, revenues in the poorest community are divided almost equally between expenditures on public services and redistributive expenditures.

The remaining communities choose an income tax of zero. They fund expenditures on public services with a combination of head taxes and property taxes. As community income rises, reliance on property taxes decreases and reliance on head taxes increases. Wealthy communities choose very high public expenditure levels. As we show later, these high expenditure levels in wealthy communities are due in part to the incentives of renter households as compared to owner occupants.

With the preceding as a baseline, we now investigate state restrictions on local taxes.

3.3 The Impact of State Prohibition of Local Income Taxes

As we noted in the introduction, several states explicitly ban the use of income taxes by local municipalities either in state statutes or in constitutions and other states effectively preclude use of local income taxes through absence of authorization for localities to impose income taxes. In this section, we study the political economy of prohibition of local income taxes. The state electorate in our analysis is the combined electorates of the city and suburbs. We determine political support by calculating the effects of banning local income taxes on the welfare of individual households and deduce from this the extent of political support for such a ban. We also calculate the aggregate welfare effects (compensating variation plus change in economic rents).

Column 2 of Table 1 shows the equilibrium with a ban on local income taxes. Since the suburbs did not use the income tax in the unrestricted equilibrium, the ban on income taxation has the effect of preventing the central-city from using an income tax. In the new equilibrium, the property tax increases to offset a portion of the revenue loss from eliminating the income tax. Per capita expenditures on local public services in the city change negligibly while redistributive expenditures per capita fall by about 45%. The reduction in income tax results in movement of higher income households into the central-city, increasing the city share of total population from 44% to 51%. As a result, the median income voter in the city is wealthier than in the equilibrium with income taxation. This wealthier pivotal voter is less favorable to redistribution than the pivotal voter in the preceding equilibrium, and this is reflected in the choice to lower redistribution while preserving spending on local public services.

The migration of households into the central-city results in a substantial increase in the gross-of-tax price of housing in the city. The net-of-tax price rises in the city as well. Gross-of-tax housing prices fall in the suburbs as a result of the migration into the city. While migrants into the city have higher incomes than previous city residents, they have lower incomes than residents who remain in the suburbs. Thus, suburban incomes rise. Per capita expenditures on public goods rise in the suburbs, reflecting the higher incomes of suburban voters, and associated higher demand for public services of those remaining.

It is then obvious that all households who were in the suburbs in the equilibrium in column (1) are strictly better off with the ban on income taxation. Those who remain in the same suburb before and after the income tax ban pay a lower gross-of-tax price per unit of housing, and they obtain higher public services. Those who move have the option of remaining in the suburb they originally occupied to obtain the lower housing price and higher public service level available in that suburb after the income tax ban. They choose to move, hence they must be better off still. Since 56% of households lived in the suburbs before the income tax ban, it follows that a majority of residents of the metropolitan area gain from the ban on income taxation. A substantial fraction of those residing in the city also favor the income tax ban, bringing total support for the ban to 66% of the metropolitan population. Thus, a state government, serving both city and suburban residents, would find strong political support for a ban on local income taxation.

3.4 State Restrictions on Property Tax Rates

State restrictions on local property taxes are very common. As noted in the introduction, forty-six of the states place some form of restriction on local property taxes, with more than half setting a limit on the property tax rate that municipalities may impose. We study the political economy of state limits on local property taxes by examining the effects of a prohibition on local income taxes in conjunction with a 35% limit on property taxes as a percentage of annual implicit rent. At discount rates of 7% to 9% (see footnote 6), this limit translates to a tax rate limit on property value on the order of 2.5% to 3%. This combination of tax restrictions corresponds closely to state restrictions in Massachusetts. Thus, these restrictions are illustrative of limitations observed in practice.

Equilibrium with the property tax limit is in column (3) of Table 1. In this equilibrium, per capita expenditures on public services in the city fall slightly, about 2%, relative to the case without a property tax limit. Redistributive expenditures per capita fall by 77%.

The forces at work with the property tax limit are similar to those that resulted from the limit on income taxation. City population increases as higher income households move in, and the wealthier pivotal voter opts to allocate the reduced tax revenues primarily to services. Suburban residents gain both from a reduction in the price of housing and an increase in public services per capita. Thus, all who resided in the suburb before the property tax limit (49% of the metropolitan population) are better off because of the tax limit. These residents, combined with city residents who gain from the tax limit, result in a total of 67% of the metropolitan population favoring the tax limit.

The welfare effects of the income tax ban and property tax limit are summarized in Table 2. As the table shows, the welfare gains prove to be quite substantial. These gains reflect the large distortions caused by unrestricted local taxes. The poorest households are worse off after the change, but a modest increase in redistributive expenditures by the state government would serve to compensate lower income households while avoiding the large distortions associated with local redistributive taxation.

3.5 Owner-Occupancy and State Tax Limitations

In Table 3, we study for owner occupants the same three cases considered for renters. Consider first the case without state restrictions. From a comparison of column (1) of Table 3 to column (1) of Table 1, we see that the city spends 16% more per capita on public services when all households are owner occupants than when all households are renters. In addition, in stark contrast to the equilibrium with renters, no redistribution is undertaken in the city when households are owner occupants. When all households are owner-occupants, the primary revenue instrument used by the city is the income tax, with a relatively modest property tax. The distribution of households across city and suburbs is also very different in the two cases. In the equilibrium with owner occupants, 57% of households reside in the city whereas only 44% do so in the equilibrium with all renters.

Comparison of column (1) of Table 3 to the corresponding column of Table 1 also reveals substantial differences in suburban spending between the two cases. The two wealthiest suburbs have much lower tax rates and lower per capita expenditure when all households are owner occupants. When all households are renters, a portion of any tax increase is shifted to landowners. When all households are owner occupants, taxes that drive down housing prices result in capital losses for occupants. Owners internalize the effects of taxes on property values, leading them to support lower taxes and expenditures.

We next consider the effect of a state prohibition on local income taxes. Comparing columns (1) and (2) of Table 3, we see that banning the income tax results in a shift toward property taxation in the city, coupled with a reduction in expenditure per capita of roughly 22%. The effects in the suburbs are relatively modest. The extent of popular support for a ban on income taxation when all households are owner occupants is markedly different than was the case with renter households. Only 25% of the population in the metropolitan area is made better off by the ban on income taxation. The imposition of a ban on income taxation results in a per capita welfare loss of $72.

Turning next to the imposition of the limit on property taxes (column 3), we see that the property tax limit results in a further reduction of expenditure per capita in the city while having relatively modest effects in the suburbs. Again, in contrast to the case with renters, this limit finds little popular support; only 17% of the population in the metropolitan area favors the ban. Limiting property taxes adds a further loss of $55 per capita. Thus, our model implies that, if all metropolitan residents were owner occupants, there would be very little popular support for state-imposed restrictions on local property and income taxes.

3.6 Owners, Renters and Tax Limits

The preceding results highlight the central role of home ownership as a determinant of local tax and expenditure policy. Those policies in turn influence the extent of popular support for state restrictions on local taxes. We now consider choice of tax policy in a metropolitan occupied by both owners and renters. To characterize policy outcomes, we employ the city-council model introduced earlier. Column (1) of Table 4 reports the outcome when there are no state restrictions on local tax policy. In this equilibrium, the median-income council member in the city is a renter. In all suburbs, the pivotal council member is an owner-occupant. We see that the city spends \$4,210 per capita, with \$2,164 of that expenditure devoted to public services and the remainder to provide a redistributive grant, with funding from a combination of property and income taxes. By contrast, the suburbs provide no redistributive grant and rely almost exclusively on head taxes for funding public services. Here, 47% of metropolitan residents reside in the city.

To provide further insight into the model with both owners and renters, we present in Figure 1 most-preferred tax rates and expenditures as a function of council member income. Council members from low-income districts prefer high income tax rates, high redistributive grants, and moderate expenditures on public services. As council member income rises, the preferred income tax rate and level of redistributive expenditure falls, and the preferred level of spending on government services rises. At incomes below \$20,692, the fraction of households who are renters exceeds half, hence the district councilperson is a renter; above that income, the fraction that is owners exceeds half and the district councilperson is an owner. The discrete changes observed in Figures 1 at this income level arise due to differing preferences of renters and owner occupants. Relative to renters, these higher-income owner occupants prefer lower tax rates, higher expenditures on government services, and no expenditures on redistribution.

Figure 2 shows the vote garnered when the median income ($19,703) council members' most preferred policy is paired against the most-preferred policy of each other council member. As the figure demonstrates, the vote favoring the median ideal point exceeds 50% in all cases. This confirms that the median ideal point is a Condorcet winner against all the other ideal points. Besley and Coate (1997) demonstrate that this condition is necessary and sufficient for a single-candidate equilibrium. Thus, the most-preferred outcome of the median-income council member is implemented.[19]

Two further points are of interest with respect to the result just described. One is that this allocation does not satisfy the Plott (1967) conditions. There are feasible alternatives that defeat the policy preferred by the median-income voter. However, those alternatives are not the most-preferred policy of any voter and thus fail the credibility restriction adopted by Besley and Coate. This result illustrates the power of the Besley-Coate framework. The second observation concerns the role of our city-council formulation. Suppose candidates not nominated by their districts could nonetheless garner the resources to run. There would then be candidates whose ideal points defeat the ideal point of the median-income council member. Such ideal points are not equilibria, however.[20] Our city-council formulation assures that such candidates do not represent their respective districts on the city-council.

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[19] The policy most preferred by owners with income above $20,692 is the same for all those owners. This accounts for the horizontal segment beginning at income $20,692 in the vote graph in Figure 2.

[20] Details documenting all claims in this paragraph are available on request.

We now turn to the outcome with a prohibition of local income taxes. The results are presented in column (2) Table 4. Expenditure per capita in the city drops more than 25% with the drop coming almost entirely in the form of a reduction of the redistributive grant. Expenditures in the city are funded entirely by a property tax, which increases by approximately 70% in response to the income tax ban. Expenditures in the suburbs are relatively little affected. The proportion of the population living in the city increases from 48% to 53% with the prohibition on local income taxation.

Imposition of the limit on property taxes results in the outcome shown in column (3) of Table 4. The median-income city-council member is an owner-occupant, and the property tax limit is not binding. This reveals that, when income taxes are prohibited, there are two equilibria, shown in columns (2) and (3). In one (column 2), a renter is the pivotal council member. Imposition of the property tax limit has the effect of selecting the equilibrium in column (3), in which an owner occupant is pivotal.[21] Interestingly, the property tax limit is not binding in equilibrium.

In the equilibrium in column (3), the city population share is 57% as compared to 52.4% in the equilibrium in which the pivotal council member is a renter. Expenditure in the city falls and additional 30% as expenditure on the redistributive grant falls to zero while expenditure on services is essentially unchanged. The property tax rate is roughly 40% lower than the value chosen when a renter is pivotal. The equilibrium in column (3) of Table 4 is preferred to the equilibrium in column (2) by 61.5% of the population in the metropolitan area, suggesting strong popular support for the limit.

[21] We have verified that this outcome is a Condorcet winner against all other council member ideal points. To conserve space, we do not present the graphs analogous to Figures 3 and 4 for this case.

The distributional effects of the prohibition of income taxation are shown in Figure 3. Owner occupants in the suburbs gain in two ways. They obtain higher public services with lower property tax rates. While those who migrate into the city are wealthier than those previously in the city, those migrants to the city are poorer than the suburban residents who remain. In the equilibrium, all suburbs have higher average incomes than previously. The associated higher tax base permits provision of higher public good levels with lower tax rates. Suburban residents also gain because the lower gross-of-tax housing prices permit them to consume more housing. Suburban owner-occupants experience capital losses on their housing, however. As Figure 3 shows, the net effect of these three factors leaves almost all suburban owner occupants better off when income taxation is prohibited. Those in the suburbs who rent experience no capital losses, so they are all better off when income taxation is prohibited. In addition, higher-income residents in the city also benefit from the prohibition of income taxation. In total, then, 58% of the metropolitan population is better off with the prohibition of income taxation.

Figure 4 displays the effects of limiting the property tax. The same forces previously described are again at work. Overall, 61.5% of the metropolitan population benefits from a limit on property tax rates.

4. Conclusion

We find that tax limitations have very substantial effects on housing prices and the composition of communities. Adjustments following introduction of tax limits result in an increase in median incomes in all communities. The electorates of all communities, but particularly the central-city, then adopt policies quite different from those that prevail in the absence of tax limitations. Tax limits thereby have striking effects on spending, reducing expenditures on redistribution and increasing per capita expenditures on public good provision in all communities.

Our model provides an explanation of political support for tax limitations. Our results provide support for Vigdor's (2001) hypothesis that support for local tax limits does not come primarily from voters wishing to limit the taxes their own locality imposes, but rather from the desire of voters to limit tax rates in localities in which they do not reside. While we propose a somewhat different mechanism than Vigdor as driving support for state tax limitations, his insight that support for tax limits comes from voters wishing to constrain taxes in other communities is nonetheless fundamental. A further insight of Vigdor's is also ratified by our analysis: A property tax limit can have large effects and yet not be binding in equilibrium. The change in community composition induced by a tax limit in turn leads to a change in the pivotal voter, and hence in the policies that voter adopts.

Finally, our analysis demonstrates the importance, when evaluating tax limits, of a framework that permits consideration of multiple policy instruments. We find that tax limits lead to large reductions in redistributive expenditures while having much more modest impact on expenditures for locally provided public goods.

Figure 1

Ideal Points as a Function of Council Member Income

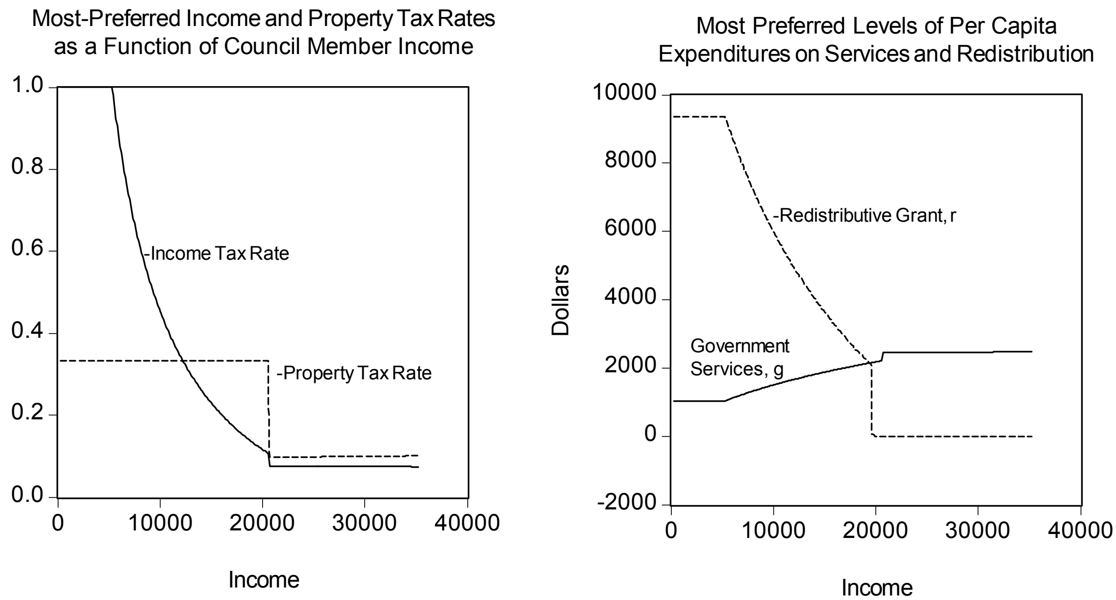

Figure 2

Vote Favoring Ideal Point of Median-Income Council Member when Paired against Ideal Points of Other Council Members

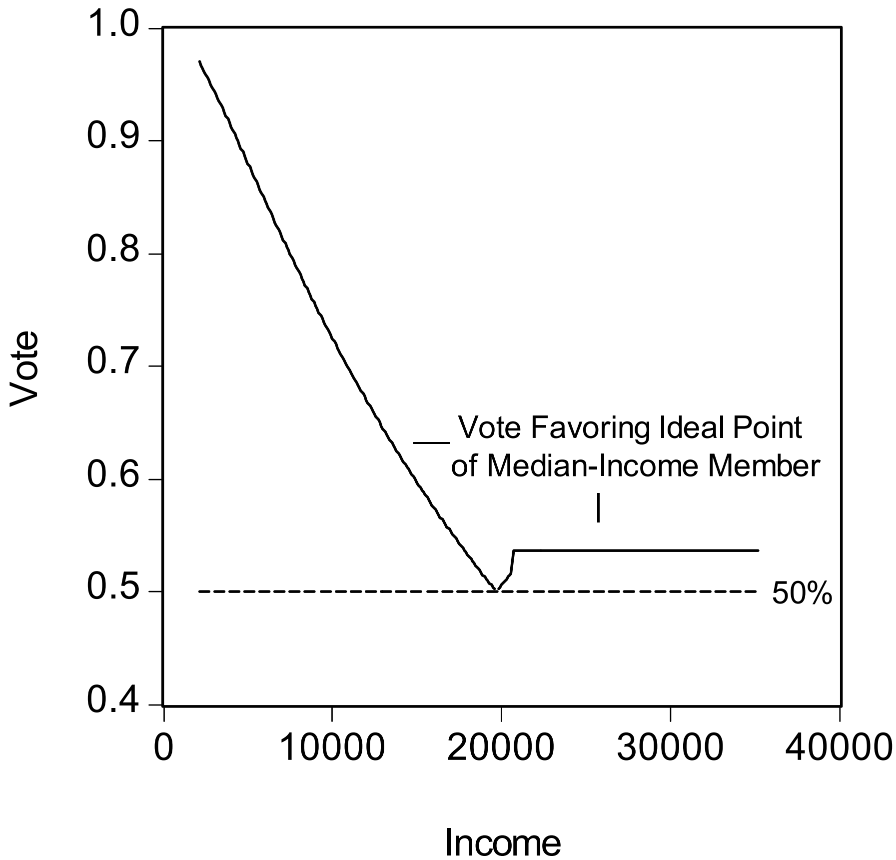

Figure 3:Welfare Effects of Prohibition of Local Income Taxes

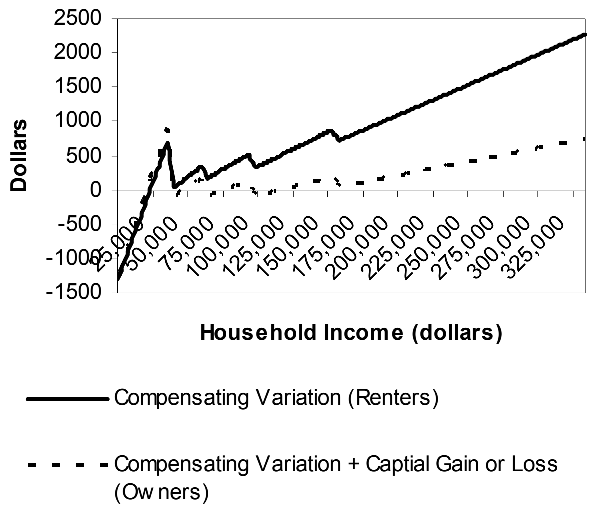

Figure 4: Welfare Effects of Imposing a Limit on Property Tax Rates when Income Taxes are Prohibited

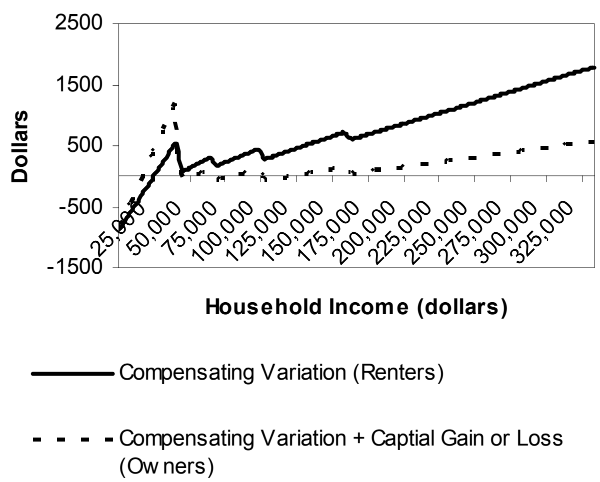

Table 1

		(1)	(2)	(3)
Property Tax Rates	t_1	0.333	0.612	0.350
	t_2	0.259	0.207	0.175
	t_3	0.099	0.078	0.064
	t_4	0.013	0.001	0.000
	t_5	0.000	0.000	0.000
Income Tax Rates	m_1	0.124	0.000	0.000
	m_2	0.000	0.000	0.000
	m_3	0.000	0.000	0.000
	m_4	0.000	0.000	0.000
	m_5	0.000	0.000	0.000
Per Capita Expenditure On Public Services	g_1	$ 2,020.72	$ 2,021.76	$ 1,976.00
	g_2	$ 4,995.46	$ 5,888.61	$ 6,664.81
	g_3	$ 9,703.75	$ 10,897.20	$11,890.06
	g_4	$ 18,317.78	$ 19,936.37	$21,512.17
	g_5	$ 42,159.43	$ 45,395.73	$47,964.11
Per Capita Grant Or Head Tax	r_1	$1,960	$1,073	$249
	r_2	-$1,765	-$2,844	-$3,749
	r_3	-$7,307	-$8,771	-$9,982
	r_4	-$17,741	-$19,871	-$21,512
	r_5	-$42,159	-$45,396	-$47,964
Population Shares	N_1	43.7%	51.2%	57.0%
	N_2	27.0%	24.1%	21.5%
	N_3	18.0%	15.2%	13.2%
	N_4	8.7%	7.3%	6.3%
	N_5	2.6%	2.2%	1.9%
Gross-of-Tax Housing Prices	p_1	$ 11.49	$ 14.46	$ 13.17
	p_2	$ 15.42	$ 14.97	$ 14.61
	p_3	$ 14.35	$ 13.90	$ 13.55
	p_4	$ 12.92	$ 12.49	$ 12.22
	p_5	$ 11.41	$ 11.07	$ 10.81
Pivotal Voter Incomes	$\tilde{y}_1$	$ 18,539	$ 20,652	$ 22,325
	$\tilde{y}_2$	$ 43,365	$ 49,849	$ 55,570
	$\tilde{y}_3$	$ 77,135	$ 85,804	$ 93,052
	$\tilde{y}_4$	$ 136,987	$ 148,435	$ 157,698
	$\tilde{y}_5$	$ 265,219	$ 281,654	$ 294,725

Table 2: Per Capita Welfare Effects of Income Tax Ban and Property Tax Limitations

	Per Capita Compensating Variation	Per Capita Change in Land Rents	Per Capita Change in Welfare
Income Tax Ban	$161.34	$-77.18	$84.16
3.5% Property Tax Limitation after Income Tax Ban	$131.70	$92.05	$223.75

Table 3

		(1)	(2)	(3)
Property Tax Rates	t_1	0.084	0.332	0.250
	t_2	0.001	0.009	0.009
	t_3	0.000	0.006	0.006
	t_4	0.000	0.008	0.008
	t_5	0.083	0.083	0.083
Income Tax Rates	m_1	0.076	0.000	0.000
	m_2	0.004	0.000	0.000
	m_3	0.003	0.000	0.000
	m_4	0.004	0.000	0.000
	m_5	0.000	0.000	0.000
Per Capita Expenditure On Public Services	g_1	$ 2,348	$ 2,132	$ 1,674
	g_2	$ 5,375	$ 5,420	$ 5,284
	g_3	$ 8,160	$ 8,213	$ 8,075
	g_4	$ 12,487	$ 12,537	$ 12,384
	g_5	$ 22,903	$ 23,054	$ 22,857
Per Capita Grant Or Head Tax	r_1	$0	$0	$0
	r_2	-$5,125	-$5,260	-$5,124
	r_3	-$7,905	-$8,042	-$7,904
	r_4	-$12,032	-$12,201	-$12,048
	r_5	-$16,321	-$16,435	-$16,288
Population Shares	N_1	56.8%	57.5%	56.1%
	N_2	18.1%	17.9%	18.6%
	N_3	12.2%	12.0%	12.4%
	N_4	8.0%	7.9%	8.1%
	N_5	4.8%	4.8%	4.9%
Gross-of-Tax Housing Prices	p_1	$ 10.91	$ 13.06	$ 12.30
	p_2	$ 12.14	$ 12.21	$ 12.26
	p_3	$ 12.19	$ 12.24	$ 12.28
	p_4	$ 12.23	$ 12.29	$ 12.33
	p_5	$ 13.70	$ 13.65	$ 13.71
Pivotal Voter Incomes	$\tilde{y}_1$	$ 22,281	$ 22,471	$ 22,060
	$\tilde{y}_2$	$ 53,098	$ 53,779	$ 52,415
	$\tilde{y}_3$	$ 80,501	$ 81,308	$ 79,927
	$\tilde{y}_4$	$ 122,127	$ 123,138	$ 121,615
	$\tilde{y}_5$	$ 212,418	$ 213,903	$ 211,965

Table 4

		(1)	(2)	(3)
Property Tax Rates	t_1	0.333	0.571	0.332
	t_2	0.002	0.010	0.009
	t_3	0.000	0.007	0.006
	t_4	0.000	0.008	0.008
	t_5	0.084	0.083	0.083
Income Tax Rates	m_1	0.121	0.000	0.000
	m_2	0.006	0.000	0.000
	m_3	0.004	0.000	0.000
	m_4	0.004	0.000	0.000
	m_5	0.00	0.000	0.000
Per Capita Expenditure On Public Services	g_1	$ 2,164	$ 2,125	$ 2,132
	g_2	$ 4,603	$ 5,027	$ 5,420
	g_3	$ 7,380	$ 7,817	$ 8,213
	g_4	$ 11,625	$ 12,098	$ 12,537
	g_5	$ 21,794	$ 22,490	$ 23,054
Per Capita Grant Or Head Tax	r_1	$2,046	$911	$0
	r_2	-$4,296	-$4,854	-$5,260
	r_3	-$7,121	-$7,645	-$8,042
	r_4	-$11,167	-$11,762	-$12,201
	r_5	-$15,492	-$16,014	-$16,435
Population Shares	N_1	47.8%	53.3%	57.5%
	N_2	22.6%	20.0%	17.9%
	N_3	14.6%	13.1%	12.0%
	N_4	9.4%	8.6%	7.9%
	N_5	5.6%	5.1%	4.8%
Gross-of-Tax Housing Prices	p_1	$ 11.96	$ 14.41	$ 13.06
	p_2	$ 12.36	$ 12.34	$ 12.21
	p_3	$ 12.43	$ 12.37	$ 12.24
	p_4	$ 12.48	$ 12.42	$ 12.29
	p_5	$ 14.01	$ 13.81	$ 13.65
Pivotal Voter Incomes	$\tilde{y}_1$	$ 19,704	$ 21,247	$ 22,471
	$\tilde{y}_2$	$ 45,341	$ 49,850	$ 53,779
	$\tilde{y}_3$	$ 72,696	$ 77,343	$ 81,308
	$\tilde{y}_4$	$ 113,534	$ 118,770	$ 123,138
	$\tilde{y}_5$	$ 201,474	$ 208,344	$ 213,903

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