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[a]Real Estate and Finance Departments, The Wharton School, University of Pennsylvania
[b]Research Department, Federal Reserve Bank of Philadelphia

ABSTRACT

This paper examines the role of U.S. housing-related tax expenditures in creating incentives for decentralization and encouraging residential sorting by income and central city decline. Tax expenditures associated with the deductibility of mortgage interest and property taxes make housing less expensive relative to other goods and, hence, increase the quantity of housing and residential land purchased and lower the density of urban areas. Because the tax expenditures increase with income and the consumption of housing services, they lower the cost of geographic sorting by income typically associated with exclusionary zoning and other land-market imperfections. A direct consequence of this sorting process is that housing-related tax expenditures are concentrated on communities with the highest incomes and house values. These effects do not arise simply because of housing-tax policies alone, but rather from the interaction of these policies and other factors that affect local real estate markets, such as zoning or fixed housing capital stocks.

Three models are developed to formally analyze these issues. In our base case model in which there are no land-use constraints and local amenities are fixed, tax deductions related to home ownership result in population decentralization within the metropolitan area and a less dense central city, but do not induce sorting by income. Moreover, land prices in the city increase because the subsidy increases the aggregate demand for housing in all communities. Thus, the mere presence of the federal housing tax expenditures increases decentralization, but cannot generate America's patterns of income sorting and central city decline.

These conclusions change in an important way in our second model in which a land-use constraint, such as the type of minimum lot size zoning prevalent in the suburbs, is introduced. In this case, the housing subsidies foster the separation of the rich from the poor. Income sorting results, and consequently, there is an increasing concentration of the poor in the central city. However, there still is no weakening of prices in city land markets in this model.

Our third and final model endogenizes the production of local amenities in the sense that they are made an increasing function of community income. In this case, three characteristics common to American urban form result: population decentralization within the metropolitan area, increased concentration of the poor in the urban core, and weak city land markets. These results indicate that America's current urban form reflects, at least in part, incentives arising from the interaction of the national tax and local zoning systems, rather than unique American tastes for low-density living environments.

I. Introduction

Compared with their counterparts in the developed world, U.S. metropolitan areas are characterized by greater population decentralization, less dense central cities, and more extreme residential sorting by income across the metropolitan area. The latter feature in particular is associated with the socioeconomic decline of many of America's larger central cities (Mills and Lubuele (1997). The traditional Mills-Muth-Alonzo (MMA) monocentric urban model offers a compelling argument that the process of decentralization is driven by increasing household income and declining transportation costs. The MMA model does not, however, offer a similarly compelling explanation for residential stratification by income or central city decline. Often, researchers claim that Americans show unique preferences for low density living to explain the spatial sorting by income that so characterizes America's urban form.[1]

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[1]The reliance on preferences can be seen in the following passage from Mieszkowski and Mills (1993):

> "...The older, smaller, centrally located units, built when average real incomes were lower, filter down to lower income groups. This natural working of the housing market leads to income stratified neighborhoods, and there is a tendency for low income groups to live in central locations and for affluent households to reside in outlying suburban areas. *The majority of the middle class apparently prefers larger single family lots in the suburbs to denser multi-family residences in the central city*." (emphasis added) (p.136).

Note that in the absence of this exogenous preference assumption, sorting by income in the traditional monocentric model would not occur because prices of more centrally located houses would simply fall until higher-income residents were indifferent across locations. [This assumes that the housing stock can be adjusted to match the demands of the higher-income residents.] While local zoning powers and Tiebout-type differences in demand for locally provided public goods can account for sorting (see Cassidy and Epple (1994, for example)), the belief that the typical American is fundamentally different from her foreign counterparts in terms of preferences for housing and living arrangements is widespread. Architect and urbanologist Witold Rybczynski begins his recent book *City Life* by quoting a friend who asks why American cities are not like European cities (Paris, to be exact). While proceeding to provide a history

Rather than making an appeal to unique American preferences, this paper presents a series of models showing how public policy, through its interaction with common features of the housing market such as minimum lot-size zoning, can create incentives for decentralization, residential sorting by income, and central city decline. The focus is on the role of U.S. tax code-related subsidies to housing, but the models apply to any policy that can materially affect the spatial price pattern differentially across households by income.

Tax expenditures associated with the deductibility of mortgage interest and property taxes are extremely large, almost $70 billion in 1996 alone,[2] and there is good reason to suspect they have helped the process of decentralization. The deduction of mortgage interest and property taxes makes housing less expensive relative to other goods and, hence, increases the quantity of housing purchased (Mills (1987), Feldstein (1982), Hendershott (1982)). If residential land use is an increasing function of quantity of housing services demanded, an increase in such subsidies will result in more land consumed per household and less densely developed urban areas. Thus, these tax expenditures reinforce the basic economic forces for decentralization suggested by the MMA model.

The potential effects of housing-related tax expenditures extend beyond reinforcing the process of decentralization. A key aspect of these implicit subsidies is that they vary across households along income lines. Because the tax expenditures increase with income and the consumption of housing services, they lower the cost of geographic sorting by income typically

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contrasting city development in the Old and New Worlds, Rybczynski's answer to his friend's query essentially boils down to the different preferences of Americans in these regards.

[2]Source: Statistical Abstract of the United States, 1996, Table No. 518: "Tax Expenditures, by Function 1994 to 1997."

associated with exclusionary zoning and other land-market imperfections. The tax expenditures not only allow high-income individuals to consume more housing in exclusive communities, but they also reduce communities' costs of setting large minimum lot size requirements to more effectively sort.

A direct consequence of this sorting process is that housing-related tax expenditures are concentrated on communities with the highest incomes and house values. To the extent that local amenities are associated with community income levels, housing subsidies not only finance sorting by income level but also foster declining land values in communities with a disproportionately high number of low income residents. These consequences are amplified by an income effect associated with the fact that the bulk of the housing-related tax expenditures is reaped in areas with high incomes and high house prices.

These sorting effects arise, not from incentives in the tax treatment of housing alone, but rather from the interaction of these incentives with other features of the housing market. For example, in our base case model in which there are no land-use constraints (such as zoning or fixed housing capital stocks) and local amenities are fixed, tax deductions related to home ownership result in population decentralization within the metropolitan area and a less dense central city, but do not induce sorting by income. Moreover, land prices in the city increase because the subsidy increases the aggregate demand for housing in all communities. Thus, the mere presence of the federal housing tax expenditures increases decentralization, but cannot generate America's patterns of income sorting and central city decline.

These conclusions change in an important way in our second model in which a land-use constraint, such as minimum lot size zoning that is prevalent in the suburbs, is introduced. In

this case, the housing subsidies foster the separation of the rich from the poor. Income sorting results with an increasing concentration of the poor in the central city. However, there still is no weakening of prices in city land markets in this model.

Our third and final model endogenizes the production of local amenities in the sense that they are made an increasing function of community income.[3] In this case, three characteristics common to American urban form result--population decentralization within the metropolitan area, increased concentration of the poor in the urban core, and weak city land markets. Essentially, the amenity differential between communities widens once income sorting begins, leading to more extreme income sorting and, under reasonable conditions, depressed city land markets. These results indicate that America's current urban form reflects, at least in part, incentives arising from the interaction of the national tax and local zoning systems, rather than unique American tastes for low-density living environments.

As an empirical matter, the extent to which tax-related housing subsidies contribute significantly to decentralization, sorting by income, and central city decline depends on the magnitude of the subsidy, the extent to which the housing subsidies lower residential land prices (instead of being capitalized into land prices), and the elasticity of residential land consumption with respect to the price of land. As is shown in section two, housing-related tax expenditures are large, especially for upper-income households. With respect to the issue of how much of the subsidy is passed forward to landowners via capitalization, it is well known that housing markets can adjust along both quantity and price margins in response to changing subsidy levels. If the

[3]This assumption is consistent with Yinger's (1986) interesting model in which sorting by income has fiscal effects that adversely affect the land values and utility in the community that has a larger share of low income people.

supply of housing is perfectly inelastic, any housing subsidy will be passed on directly to the land owner. In this case, the after-subsidy price of land would be unchanged, and subsidies would have no effect on the urban form. While there are good reasons to expect housing supply to be relatively inelastic in cities, housing supply should be relatively elastic on the urban fringe (Voith (1996)). Siani (1997) finds relatively small capitalization of federal income tax changes into house values. Assuming a discount rate of 9 percent, Siani (1997) calculates that 13 percent of the present discounted value of a permanent tax change is reflected in the asset price of housing.[4] The price elasticity of the residential demand for land is an issue in urgent need of research so that the effects of the housing-related tax expenditures on urban form can be computed.

The remainder of the paper is organized as follows. Section two presents evidence on the extent of decentralization, the degree of sorting by income across suburbs and central cities, the magnitudes of housing subsidies for individuals of various incomes and rates of housing consumption, and the aggregate distribution of housing-related tax expenditures across suburbs and central cities. This section also addresses the roles of prices and preferences in the processes of decentralization and sorting. Section three presents the basic analytical framework for evaluating the spatial and distributional consequences of the housing-related tax policies. Section four presents the comparative statics of the model, delineating the conditions under which the tax expenditures essentially finance decentralization, sorting, and central city decline. Section five concludes and raises issues requiring additional theoretical and empirical work.

[4]Siani's (1997) result reflects an average across city and suburban markets.

II. Decentralization and Income Sorting: Prices or Preferences?

With the exception of those in Australia, U.S. metropolitan areas and their central cities tend to be less densely populated than their counterparts in the rest of the developed world. Table 1 shows an international comparison of the density of metropolitan areas and their central cities.[5] Columns 1 and 2 of Table 1 show metropolitan areas and their densities sorted by metropolitan area density. Columns 3 and 4 show the cities and their densities, this time sorted by city density. These data clearly show that U.S. and Australian metropolitan areas and central cities are far less dense than their European and Asian counterparts.

Population in metropolitan areas throughout the developed world has been decentralizing in the second half of the 20th century.[6] Many central cities have experienced not only population declines relative to their suburbs but also absolute population declines as well. This trend has been very strong in the U.S. despite the relatively low initial density of U.S. central cities. Table 2 documents the changes in population and relative city/suburban population shares for the 20 largest U.S. cities that have had no change in their land area. Because we have chosen cities whose land area has not changed over time, changes in density are the same as changes in population. With the exception of Los Angeles, Miami, and Oakland, all of the cities lost population from 1960-90, resulting in lower densities. Over half of the cities experienced population and density declines of more than 20 percent. The share of metropolitan-area

[5]Metropolitan area definitions differ across countries, and the underlying definitions of central cities and metropolitan areas are not always comparable. Newman and Kenworthy (1989) have assembled data on large metropolitan areas and their central cities that are intended to have broadly comparable definitions for the metropolitan areas and their central cities.

[6]There has been a great deal of research documenting the process of decentralization internationally. See Meiszkowski and Mills (1993) for review of these studies.

population living in the central city declined in every metropolitan area. In all but three areas, the city's share of population fell more than 20 percent.

Not only have most U.S. cities lost population, but all of the central cities examined systematically lost higher income residents. Table 3 shows the ratio of city per capita income to suburban per capita income in 1960 and in 1990, as well as the change in that share from 1960-90. In 1960, city per capita incomes averaged 93.2 percent of suburban incomes and eight of the 20 cities had higher average per capita incomes than their suburban counterparts. By 1990, city per capita incomes averaged only 75.3 percent of suburban per capita incomes and only two cities had average incomes that were greater than or equal to those of their suburban neighbors. City income relative to suburban income fell in all 20 cities from 1960-90.

As a purely statistical matter apart from the causal forces investigated in the models below, the population decentralization and sorting by income across city and suburbs evident in Tables 2 and 3 has strong implications for the distribution of housing-related tax expenditures across communities. Sorting by income causes differential incidence of housing tax expenditures because tax-code-related housing subsidies are much larger for high-income households than for lower-income households. Tax-code-related housing subsidies are larger for higher-income households for three reasons: 1) higher-income households purchase more expensive houses; 2) higher-income households have higher marginal tax rates; and 3) lower-income households seldom find it advantageous to use itemized deductions, which eliminates the possibility of receiving the subsidy. To the extent that high- and low-income households sort into separate communities, housing tax expenditures will be skewed towards communities with higher-income residents.

Table 4 shows the estimated values of mortgage and property tax deductions for various house values.[7] For a married couple purchasing a residence worth over $225,000, in just the first year, the value of the deductions of mortgage interest and property taxes in excess of the standard deduction is estimated to be over 2 percent of home price. Given that 30-year mortgages amortize slowly, the subsidy rate falls only slightly in the near term even in the absence of releveraging. Hence, the present value of the subsidy stream amounts to a very significant fraction of purchase price for owners of relatively expensive housing. The converse is true for purchasers of relatively inexpensive units. Under reasonable conditions, the sum of ownership-related deductions on a $75,000 house does not exceed the standard deduction for a married couple. Thus, there is no effective subsidy to housing consumption for married owners of these units.

The implications for the spatial distribution of these subsidies within the metropolitan area are outlined in Tables 5 and 6. Table 5 reports data from the 1990 Census publication *General Housing Characteristics* (CH-1-1). Information on the distribution of homes across the price distribution is presented for owner-occupied homes inside and outside the central cities of government-defined metropolitan areas.[8] In 1990, the Census reports that there were 44,045,859 owner-occupied units within metropolitan areas. Of that total, only 14,588,932, or 33 percent, were located inside the central city (or cities) of those metropolitan areas. It is also evident that the majority of the owner-occupied units inside central cities have values below the $85,000

[7]See the Appendix for the details behind these calculations.

[8]By restricting the analysis to metropolitan areas, most rural housing units are ignored, making possible a more sensible central city-suburban comparison.

cutoff point at which ownership-related deductions exceed the standard deduction for a married couple. Outside central cities, only 37 percent of the owned units have values below $80,000. Thus, two-thirds of 'suburban' owners receive some subsidy to housing while less than one-half of city owners do.

Table 6 then reports the aggregate housing subsidies/tax expenditures accruing to central city and suburban residents of metropolitan areas given our assumptions for leverage, interest rates, taxpayer status, and marginal tax bracket (i.e., those underlying Table 4). Since the value of annual ownership-related deductions does not exceed the standard deduction for a married couple for owners of homes valued at $75,000 or below, the aggregate subsidy to those owners is zero. From Table 4 we know that for an $85,000 home, the value of ownership-related deductions in excess of the standard deduction is $141 in the first year for a married couple in the 28% bracket. Multipling $141 by the 921,292 central city owners and 2,097,099 suburban owners of such homes yields tax expenditures/housing subsidies of $130,270,689 and $296,529,799, respectively.

These subsidies/tax expenditures pale in comparison to those reaped by owners of expensive housing--the bulk of which accrue to suburban property owners. For example, the 11.3 percent of suburban owners of units valued at $250,000 or more receive $40.4 billion in subsidy--69 percent of the total received by all owners in the suburbs. In the city, the 7.7 percent of owners who reside in units valued at more than $250,000 receive $13.5 billion in subsidies to housing consumption--71 percent of all subsidies received by central city homeowners.

The ex post differences in housing-related tax expenditures across communities is an indication of the magnitude of policy-generated financial support underlying the current spatial

distribution of population and income. Housing subsidies of this magnitude that have differential incidence across communities suggest that the decentralized, stratified urban form of America's cities could be the result of people reacting to a price system profoundly affected by tax policy as opposed to a reflection of intrinsic American preferences for low density, stratified communities.

The extent to which differences in urban form across nations reflect preferences as opposed to pricing differentials is an extremely important question because the answer largely determines whether and how the government should act to shape urban development. For example, Meiszkowski and Mills (1993) write that

> "...if households prefer to live in low density suburbs, and to use automobiles as their primary means of intra-urban transportation, the public sector should validate these preferences with the appropriate highway and infrastructure investments." (p.144).

However, they go on to note that fiscal distortions affecting location decisions could lead to a very different conclusion. Hence, it is important to understand whether public policy could have led to distortions that helped generate the urban form we see in America's metropolitan areas.

III. The Analytical Framework

The models presented below are in the Tiebout tradition in the sense that distance as represented by access to the urban core plays little or no role. While simple, the models capture the central features of the individual's location choice under alternative assumptions regarding the nature of land-use constraints, the production of public amenities, and urban agglomeration economies. The conclusions still hold in a world in which distance to a central employment location is relevant, but they are much easier to show in a framework without space.

Characterization of the Metropolitan Area

There is a single metropolitan area consisting of two jurisdictions indexed by $j = (c,s)$, with c denoting the central city and s denoting the suburban jurisdiction. Central city boundaries are exogenously given and cannot be changed so that the central city's land area is fixed in size. In contrast, unimproved land is assumed to be perfectly elastically supplied in the suburban region. Because suburban land is perfectly elastically supplied, its price is equal to the price of agricultural land plus the value of public amenities, which are available only where agricultural land has been converted to residential use. The two jurisdictions are characterized by their pre-subsidy house prices, r_j, as well as location-specific attributes for each jurisdiction, A_j.

In addition, two types of workers indexed by i=(h,l), with h denoting high skill and l denoting low skill, live in the metropolitan area. Each group is fixed in size, and high-skill workers earn wage w^h and low-skill workers earn wage w^l. The distribution of these two groups across the metropolitan area depends on preferences, equilibrium prices and amenities, and housing subsidies.

Characterization of the Housing Subsidy

The mortgage interest and property tax deductions lower the after-tax price of housing. The value of the deduction for any individual depends on whether the individual finds it advantageous to use itemized deductions, on her marginal tax rate, and on her level of housing consumption. Generally, the deduction is of higher value for higher-income individuals. For simplicity, we specify the mortgage interest and property tax deductions as a subsidy, τ^i, defined as the fraction of the house price paid by the government. It is also presumed that the level of the standard deduction and the progressivity of the tax code combine to function so that the housing

subsidy is available only to high-skill workers. Thus, $0<\tau^h < 1$, with $\tau^l = 0$.

Preferences

Individuals consume a market good, x, (whose price is the numeraire) and housing services, h_j. In addition, utility is derived from location-specific amenities, A_j. An individual consumer, k, maximizes utility by choosing residential location and optimal quantities of x and h_j given r_j, τ^i, A_j, and w^i. More formally,

$$(1) \qquad \text{Max } U^{ik}(x, h_j; A_j) \quad \text{Subject to:} \quad x + (1 - \tau^i) r_j h_j = w^i.$$

Individuals of a given type are assumed to have identical preferences over x, h_j, and A_j, but they differ in their preferences for city or suburban location. The utility function is defined such that the indirect utility function, V^{ik}, takes the following form

$$(2) \qquad \begin{aligned} &\text{High skill:} \quad V^{hk} = V(r_j, \tau^h, w^h; A_j) + \varepsilon_j^{hk} \\ &\text{Low skill:} \quad V^{lk} = V(r_j, w^l; A_j) + \varepsilon_j^{lk}, \end{aligned}$$

where V(.) is the systematic component of utility and ε_j^{ik} is the increment to indirect utility associated with the choice of location j. Note that ε_j^{ik} is normalized such that it represents the incremental utility associated with an individual choosing a suburban location. Specifically, let $\varepsilon^{ik} = \varepsilon_s^{ik} - \varepsilon_c^{ik}$ define the relative idiosyncratic preference for locations c and s.

Location Choice

Because all consumers have identical tastes except for idiosyncratic preferences for city or suburban living, the marginal consumer is defined (separately for rich and poor individuals) by that ε^k, ε^{i*}, satisfying

(3) $$\varepsilon^{i*} = V_s^i - V_c^i.$$

More formally, for each worker type the marginal consumer is defined such that

(3') $$\varepsilon^{h*} = V(r_s, \tau^h, w^h; A_s) - V(r_c, \tau^h, w^h; A_j)$$
$$\varepsilon^{l*} = V(r_s, w^l; A_s) - V(r_c, w^l; A_j).$$

By specifying a density function, Ψ^i, for ε^{i*}, the fraction of rich or poor individuals choosing city residences, n_c^i, can be determined as a function of r_j, w^i, and A_j.

One further simplification is to focus on the difference in amenities, A, rather than the absolute levels of amenities in city and suburbs. Thus, let $A=A_s-A_c$, with the population distributed as in

(4)-(5) $$n_c^i = \Psi^i(r_s, r_c, A), \text{ for } i = h, l.$$[9]

Housing Demand

Given an indirect utility function, Roy's identity provides the demand for housing by each

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[9]Because the signs of the first partials of these functions will be important later, it is helpful to determine them now. Downward-sloping demand implies that the fraction of people choosing a city residence declines as city rents increase, so that $\partial\Psi^i/\partial r_c = \Psi^i_{r_c} < 0$; similarly $\partial\Psi^i/\partial r_s = \Psi^i_{r_s} > 0$. Increases in city amenities or a reduction in suburban amenities should increase the number of people who choose city residences. Because A represents suburban amenities relative to city amenities, $\partial\Psi^i/\partial A = \Psi^i_A < 0$. Note also that the fraction of either high- or low-skill people living in the central city or suburban portion of the metropolitan area is assumed not to be directly affected by τ^h because the housing subsidy applies equally (on a percentage basis) to any given city or suburban housing unit. Similarly, w^i does not affect the population distribution because wages for individuals of a given type within the single metropolitan area labor market are assumed to be the same in both jurisdictions.

individual. Given the choices of jurisdictions, the aggregate housing demand is a function of r_j, τ^h, w^h, and n_j^h for high-skill individuals and r_j, w^l and n_j^l for low-skill individuals as shown in equations (6)-(9).

(6)-(7) $H_j^h = H^h(r_j, \tau^h, w^h ; n_j^h)$, for j=c,s ;

(8)-(9) $H_j^l = H^l(r_j, w^l ; n_j^l)$, for j=c,s.[10]

Housing Supply

Housing services are assumed to be proportional to developed land. Further, there is no vacant land in the city because of another assumption that all land there is developed.[11] Thus, the total supply of housing services in the city, H_c, is fixed. Consequently, the following constraint applies for the city portion of the metropolitan area

[10]Once again, the signs of a variety of marginal effects on housing demand will prove of interest for the comparative static analysis below. First, the amount of housing consumed by both high and low skilled workers obviously decreases with increases in the price of housing services, so that $\partial H_c^i/\partial r_c = H_{c_{r_c}}^i < 0$ (with the analogous result holding for suburban region). For high skilled individuals who are able to use the mortgage interest deduction, the subsidy to housing consumption increases their demand for housing in the central city, so that $\partial H_c^h/\partial \tau = H_{c_\tau}^i > 0$. Finally, city housing demand is increasing in wages and in the number of people choosing to live in the city, with $\partial H_c^i/\partial w^i = H_{c_{w^i}}^i > 0$ and $\partial H_c^i/\partial n_c^i = H_{c_{n_c^i}} > 0$.

[11]In this model, when population falls in the city, the remaining city residents consume more city housing services. Implicitly, we assume that the housing stock adjusts in terms of size of housing to match demand. This is obviously unrealistic in the short run, as housing that does not match consumer demands is often left vacant. It should be noted, however, that this sort of fixity of city housing stock will only reinforce the types of results we show later with regard to sorting by income.

(10) $H_c = H_c^h + H_c^l$

IV. Comparative Statics

Case 1: Fixed Amenities and Wages, No Lot-Size Constraints

The first case considered is the simplest. Wages and amenities are exogenously given and no land-use constraints of any type are present. With w^i and A_j exogenously fixed, equations (4), (5), (6), (8), and (10) form a system of five equations in five variables r_c, n_c^h, n_c^l, H_c^h, H_c^l. Note that r_s does not adjust in this case because agricultural land is perfectly elastically supplied and amenities are fixed by assumption.

To examine the effects of changing the mortgage interest deduction on location choices and housing consumption by high- and low-skill workers, as well as city land prices, these equations can be totally differentiated as follows,

(11) $$dn_c^h = \Psi_{r_c}^h dr_c$$

(12) $$dn_c^l = \Psi_{r_c}^l dr_c$$

(13) $$dH_c^h = H_{c_\tau}^h d\tau + H_{c_{r_c}}^h dr_c + H_{c_{n_c^h}}^h dn_c^h$$

(14) $$dH_c^l = H_{c_{r_c}}^l dr_c + H_{c_{n_c^l}}^l dn_c^l$$

(15) $$dH^h = -dH^l.$$

Equations (11)-(15) then can be solved for $dr_c/d\tau$, $dn_c^h/d\tau$, $dn_c^l/d\tau$, $dH_c^h/d\tau$, and $dH_c^l/d\tau$. [Hereafter, we drop the superscript on τ, since it is assumed relevant only for high-skill workers.] Consider first the effects of a change in subsidies on the price of housing services in the city which is given by equation (16),

(16) $$\frac{dr_c}{d\tau} = -\frac{H_{c_\tau}^h}{H_{c_{r_c}}^l + H_{c_{n_c^l}}^l \Psi_{r_c}^l + H_{c_{r_c}}^h + H_{c_{n_c^h}}^h \Psi_{r_c}^h} > 0.$$

The numerator is clearly positive since the demand for housing increases with the level of the housing subsidy. With respect to the denominator, because the demand for housing by each skill type falls as price increases, the first and third terms are negative. The second and fourth terms are also negative because housing demand is increasing in the number of people choosing the city, but the number choosing the city is decreasing in city prices. Thus, equation (16) is strictly positive. This is not surprising since an increase in housing subsidies increases the overall demand for housing, which, in turn, increases city prices because housing in this part of the metropolitan area is inelasticly supplied.

Solving for the effect of housing subsidies on the distribution of high- and low- skill people yields equations (17) and (18),

(17)-(18)
$$\frac{dn_c^i}{d\tau} = \Psi_{r_c} \frac{dr_c}{d\tau} < 0 \qquad i=h,l.$$

Recall that $\Psi_{r_c}^i < 0$ because fewer people choose to live in the city as city rents increase. And, equation (16) just showed that increases in the federal tax subsidy raise city rents. Thus, a higher housing subsidy reduces the number of high- and low-skill workers choosing to live in the city. Essentially, the housing subsidy causes everyone to substitute housing for other goods. Because city land is in fixed supply, the rising city prices cause both skill types to shift demand to the suburbs where housing is elastically supplied.

However, because the housing subsidies are usable only by high-skill workers, they have differential effects on housing consumption across worker types. For high-skill workers, the effect on city housing demand is given by equation (19)

(19)
$$\frac{dH_c^l}{d\tau} = H_{c_{r_c}}^l \frac{dr_c}{d\tau} + H_{c_{n_c^l}}^l \frac{dn_c^l}{d\tau} < 0.$$

Since the amount of city housing purchased by a low-skill person falls with increases in price (i.e., $\partial H_c^l/\partial r_c<0$), and increases with the number of low-skill people in the city (i.e., $\partial H_c^l/\partial n_c^l>0$), both terms of equation (19) are negative. Some low-skill workers end up in the suburbs because

the housing subsidy to high-skill workers is driving up city rents. This leaves aggregate demand by the low skill types lower in the city.

For high-skill workers, the housing subsidy has the opposite effect. From equation (10),

$$\frac{dH_c^h}{d\tau} = -\frac{dH_c^l}{d\tau} > 0. \tag{20}$$

Even though the housing subsidy reduces the number of high-skill people choosing to live in the city, housing consumption by the remaining high-skill workers increases. This occurs because the after-subsidy price of housing in the city falls for this group (even though the market price of city housing rises). For this type, fewer people consume more housing in the city.

In summary, population decentralization within the metropolitan area and a less dense central city result from the mortgage interest deduction. However, the federal tax policy induces no sorting. Not only is there no socioeconomic decline associated with an increasing concentration of the poor in the city, but high-skill workers end up consuming more of the city housing stock as a result of the tax-code-related housing subsidies.

Case 2: Fixed Amenities and Wages, With Lot-Size Constraints

The second case introduces a common suburban land-use restriction in the form of a minimum lot-size requirement for residential development. To help simplify the analysis here, it is assumed that lot-size constraints exist such that no low-skill people choose to live in the suburbs, but the constraints are not binding for high-skill workers.[12] In other words, high-skill

[12]The model would generate the same qualitative results with a weaker assumption. The only requirement is that zoning preclude some low skill workers from choosing a suburban

workers earn sufficiently high wages that they always choose lots at least as large as the constraint whenever they choose a suburban site. Low-skill workers, on the other hand, have sufficiently low wages that they never choose to purchase a lot as large as the minimum in the suburbs.

These simplifying assumptions concerning lot size imply the following modifications to the comparative statics analyzed in Case 1. Equation (12) is no longer relevant, since low-skill workers never choose to live in the suburbs, and equation (14) simplifies to:

(21) $$dH_c^l = H_{c_{r_c}}^l dr_c.$$

Although the signs of the comparative statics are unchanged from those of Case 1, the effects of a housing subsidy on city rents are greater as shown in equation (22)

(22) $$\frac{dr_c}{d\tau} = -\frac{H_{c_\tau}^h}{H_{c_{r_c}}^l + H_{c_{r_c}}^h + H_{c_{n_c^h}}^h \Psi_{r_c}^h} > -\frac{H_{c_\tau}^h}{H_{c_{r_c}}^l + H_{c_{n_c^l}}^l \Psi_{r_c}^l + H_{c_{r_c}}^h + H_{c_{n_c^h}}^h \Psi_{r_c}^h} > 0.$$

The right-most expression in equation (22) is simply that from equation (16) for Case 1. The intuition behind why city rents are higher in this case with binding lot size constraints in the suburbs is that because low-skill workers cannot adjust by changing location, the overall demand for city housing drops less. The larger impact on rent, however, means that more high-skill

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location.

people choose to leave the city than otherwise would have occurred (the comparative static is the same equation as equation (15)).

Thus, in the presence of lot-size constraints, housing subsidies such as those arising from the mortgage interest deduction to higher income people foster the separation of the rich from the poor. The rate of loss of city population is somewhat lower, however, as the city does not lose the poor. This case leads to less decentralization, but the prediction of sorting by income across jurisdictions is consistent with the increasing concentration of the poor in many central cities. However, the even higher prices in the city land market predicted by this model are not consistent with the data in many urban areas.

Case 3: Endogenous Amenities, Fixed Wages, with Lot-Size Constraints

The production of local public amenities is endogenous in this case. Amenities in a jurisdiction are assumed to depend on the number of high-skill workers residing in the jurisdiction. This is consistent with amenities being normal goods whose demand increases with community income and with the existence of peer group effects in which high-skill workers positively affect the utility of high- and low-skill workers alike.

To examine the effects of endogenously produced amenities, the basic model must be augmented with two additional equations: one that determines the effect of amenities on rent and another that determines the level of amenities. Recall that the price of suburban residential land is simply the value of agricultural land plus the value of amenities. Suburban residential land prices vary with A as in equation (23)

(23) $$r_s = r(A).$$

The level of relative amenities depends on the number of high skilled workers choosing to live in the city so that

(24) $$A = A(n_c^h).$$

Because equations (23) and (24) do not arise explicitly from the maximization problem outlined above, some restrictions are needed to ensure sensible outcomes. In particular, we assume that increases in amenities resulting from a greater concentration of high-skill workers do not raise prices so fast as to more than offset the utility from the additional amenities. In other words, the positive effect of A on the fraction of people choosing suburban residences is always assumed to be greater than or equal to the negative effect on suburban residential choice resulting from A's positive effect on suburban prices. Mathematically, this can be stated as

as $\Psi_A A_{n_c^h} \geq \Psi_{r_s} R_A A_{n_c^h}$.

Totally differentiating equations (4), (6), (8), (10), (23), and (24) results in a system of six equations and six unknowns: r_c, r_s, n_c^l, H_c^h, H_c^l, A. The differential equations for housing demand and supply (equations (13)-(15)) are unchanged but equation (11) now must take into account changes in suburban prices and relative amenities as shown in equation (25)

(25) $$dn_c^h = \Psi_{r_c}^h dr_c + \Psi_{r_s}^h dr_c + \Psi_A dA.$$

In addition, the total differentials for equations (23) and (24) are given by

(26) $$dr_s = R_A\, dA$$

(27) $$dA = A_{n_c^h}\, dn_c^h.$$

Equations (13), (14), (15), (25), (26), and (27) can be solved for the effects of changes in housing subsidies on the number of high-skill people choosing to work in the city, rents in the city, relative suburban/city amenities, and housing consumption in the city by high- and low-skill workers.

Consider first the effects of housing subsidies on the fraction of high-skill workers choosing to live in the city. Algebraic manipulation yields:

(28) $$\frac{dn_c^h}{d\tau} = \frac{\Psi_{r_c} H_{c_\tau}^h}{(1 - \Psi_{r_s} R_A A_{n_c^h} - \Psi_A A_{n_c^h})(-H_{c_{r_c}}^h - H_{c_{r_c}}^l) - \Psi_{r_c} H_{c_{n_c^h}}^h} < 0$$

The numerator is always negative for reasons discussed in the previous cases. Given the assumptions regarding the relationship among amenities, suburban prices and choice of residential location (i.e., as $\Psi_A A_{n_c^h} \geq \Psi_{r_s} R_A A_{n_c^h}$), the denominator is always positive. Thus,

making amenities a function of the per capita wealth of the community does not change the direction of this effect. Rather, endogenizing amenities reinforces the effects of the housing

subsidy because suburban communities become more attractive while city communities become less attractive in terms of amenities. Mathematically,

(29) $$\frac{dA}{d\tau} = A_{n_c^i}\frac{dn_c^i}{d\tau} > 0.$$

Because the relative position of the suburbs and city in regard to amenities is endogenous, the effect of housing subsidies on city prices may be positive or negative. The effect of housing subsidies on city prices is shown in equation (30)

(30) $$\frac{dr_c}{d\tau} = \frac{H_{c_\tau}^h}{-H_{c_{r_c}}^h - H_{c_{r_c}}^l} + \frac{H_{c_{n_c^h}}^h}{-H_{c_{r_c}}^h - H_{c_{r_c}}^l}\frac{dn_c^h}{d\tau} \lessgtr 0.$$

In the previous two cases, housing prices in the city unambiguously rose because overall demand for housing both in the city and the suburbs rose. In this case, the increased exodus of high-skill workers from the city induced by the housing subsidies lowers the relative attractiveness of the city's amenities. Thus, the housing subsidy has countervailing effects on city prices as represented by the two terms in equation (30). If amenities are strongly sensitive to the composition of the population, it is possible that the housing subsidy can cause a decline in residential prices in the city.

In sum, this case predicts a number of empirical phenomena common in U.S. metropolitan areas: decentralization accompanied by sorting by income with increased

concentrations of the poor in the city, low amenities in the city, and relatively low residential prices in the city. That is, decentralization within the metropolitan area is accompanied by socioeconomic decline and weak city land markets.

V. Conclusions

While some stratification by income is predicted by the traditional urban economic theory of metropolitan area development, the socioeconomic distress of many of our larger cities is not. Decentralization and decline are distinct phenomena. The former is associated with a loss of population share by the central city. The latter is associated with increasing concentrations of poverty and depressed land markets in the central city. A primary goal of our models has been to ascertain the conditions under which subsidies to housing consumption that vary across households might have helped generate these conditions. This was accomplished by modeling the impact of federal tax policy as expressed through housing-related deductions as they interact with suburban zoning constraints on lot size and local amenity packages that are endogenously determined with community demographics.

In the absence of effective lot-size zoning rules, the mortgage interest deduction leads to increased decentralization but no socioeconomic decline associated with sorting by income and increased poverty concentrations in the city. In fact, the pre-subsidy price of city housing rises, with housing consumption in the city by itemizers also rising because their after-subsidy housing price is lower.[13]

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[13]This may help explain why city representatives did not vigorously oppose the introduction of the mortgage interest deduction. In the absence of large lot zoning rules in the suburbs (which did not become extensive and binding until the late 1960s), this particular housing subsidy may not have been viewed as especially harmful to central cities. Loss of

The interaction of federal tax policy regarding housing with large-lot zoning in the suburbs was found to be particularly interesting. The subsidy effectively increases the net benefits of sorting--beyond those implied by standard motivations to engage in fiscally exclusionary zoning. The two policies combine to produce decentralization and increased concentration of the less well off in the city. If the production of amenities is endogenous so that they are a function of the local population, city land prices can also decline. The more sensitive amenities are to the makeup of the local population, the greater potential for collapsing city land prices. Our theoretical models do not take into account the likelihood that the housing tax expenditures make it less costly to introduce exclusionary zoning that would augment the negative consequences of the interaction between housing tax expenditures and exclusionary zoning.

Population decentralization within the metro area, socioeconomic decline in the city, and weakening city land markets result from public policy that affects prices and the constraints households face when making location and consumption decisions. Determining the empirical importance of these policy effects is an important area for future research.

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population share should have been anticipated, but with the benefit of greater housing consumption by the better off remaining in the city.

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Appendix

Table A1 provides the details of the back-of-the-envelope-type estimates of the value of ownership-related deductions for households occupying homes of varying prices. While the calculations are crude, they ably highlight the key conclusion of the table: that the subsidy to housing consumption, which must be calculated net of the standard deduction that would apply in any case, is zero or very small for owners of inexpensive homes and is very large for owners of the most costly homes. That said, five key assumptions drive the results reported in the table: (1) mortgage size, which is determined by an assumed 80 percent loan-to-value (LTV) ratio, is reported in column two; this probably is a fairly accurate representation of the leverage only on a recently purchased home; (2) mortgage interest rate, which is assumed to be 8.5 percent on an annual basis; this reflects current market conditions, but not those of the past; the interest due during the first year on an 80 percent loan-to-value (LTV) mortgage is reported in column three; (3) the effective property tax rate, which is assumed to be 1.5 percent, is reported in column four; (4) the size of the standard deduction which varies by taxpayer status in reality; for simplicity in Table 1, all owners are presumed to be married couples so that the standard deduction of $6550 that applied in 1995 is available; column six reports the difference between the sum of the two ownership-related deductions and $6550; unless this difference is positive, there is no real subsidy to ownership, as the standard deduction will be taken in lieu of the taxpayer itemizing;[14] (5) marginal tax rates, which range from a low of 15 percent to a high of 39.6 percent, per the

[14]A household could have other deductions, such as large medical expenses or a local wage tax, that lead it to itemize. In such a case, the mortgage interest and property taxes would be valued to the extent that the sum of itemized expenses exceeded the standard deduction. That possibility is not modeled in our tables.

current tax code;[15] because mortgage interest and local property taxes are deductible expenses, not tax credits, their value is a function of the taxpaying unit's marginal tax rate.

Column 8 reports the product of multiplying the presumed marginal tax rate times the amount of ownership-related deductions in excess of the standard deduction. For those owners of less expensive homes below $85,000 for which the sum of ownership-related deductions is less than the standard deduction, the value is set to zero, indicating that they receive no subsidy from ownership.[16] For owners of more expensive homes, the value of ownership-related excess deductions ranges from a low of $141 to $13,840 during the first year of ownership.

Column 9 of Table 1 illustrates the size of the subsidy in terms of home price. Specifically, the value of ownership-related excess deductions as a percentage of house value are reported. For the owner of an $85,000 home, the first year subsidy amounts to only 0.2 percent of price ($141/$85,000). However, the first year value of ownership-related deductions for owners of homes at least $225,000 in value is above 2 percent of home price.

Given the very low initial principal paydowns on fully amortizing, 30-year mortgages, these subsidies remain roughly constant in the first few years of occupancy. Unless releveraging occurs after that, the value of the subsidy will decline. While the present value of the subsidy stream is difficult to pin down, there is no doubt that the subsidy is zero for owners of the least expensive homes, is of small to moderate size for those owning the median-priced home, and is quite large for occupiers of relatively expensive housing priced above $150,000.

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[15]With various phase-out provisions and the uncapping of the Medicare tax, the top marginal rate is higher than 39.6 percent. The analysis abstracts from these details of the tax code. Suffice it to say that the value of being able to itemize housing-related deductions increases with the marginal tax rate.

[16]According to data from the National Association of Realtors, the median home price for existing homes in 1995 was $112,900.

Table 1
Central City and Metropolitan Area Density
Population per Square Mile (1980)

City	City Density	City	Metro Density
Perth	4004.4	Phoenix	2199.5
Brisbane	4797.9	Houston	2300.5
Adelaide	4863.8	Brisbane	2645.6
Phoenix	4937.4	Perth	2787.5
Denver	5003.0	Denver	3083.1
Houston	5343.8	Boston	3127.4
Melbourne	7588.3	Adelaide	3342.8
Los Angeles	7661.5	Washington	3426.1
Sydney	10135.6	Detroit	3650.5
Washington	11442.2	San Francisco	4011.8
Boston	11612.7	Melbourne	4250.4
Detroit	12460.4	Chicago	4527.4
Chicago	14025.0	Sydney	4547.7
Toronto	14640.6	Los Angeles	5188.9
Stockholm	15093.5	New York	5560.8
San Francisco	15230.8	Toronto	10259.9
Copenhagen	15356.6	Hamburg	10808.0
Frankfurt	16180.1	Paris	12488.7
Zurich	20438.3	Amsterdam	13151.5
Amsterdam	21568.6	Stockholm	13293.6
West Berlin	21638.8	Zurich	13902.8
Hamburg	22913.2	Frankfurt	13984.3
Brussels	26032.4	Munich	14732.2
Paris	27556.2	West Berlin	16464.3
New York	27665.8	Brussels	17457.2
Vienna	34337.6	Copenhagen	17917.9
Tokyo	39613.8	Vienna	18676.3
Munich	41238.4	Singapore	21566.9
Singapore	52203.8	Tokyo	27091.6
Hong Kong	268601.8	Hong Kong	75991.5

Source: Newman and Kenworthy (1989).

Table 2
Changes in Central City Population and
Central City Share of Metropolitan Population
U.S. Cities 1960-1990

	Percent Change in Population	Percent Change in Central City Share of Metropolitan Population
St. Louis	-47.1	-54.0
Cleveland	-42.3	-39.8
Pittsburgh	-38.8	-29.5
Detroit	-38.5	-43.1
Buffalo	-38.4	-32.3
Cincinnati	-27.6	-36.7
Minneapolis	-23.7	-50.1
Baltimore	-21.6	-40.1
Chicago	-21.6	-28.6
Philadelphia	-20.8	-29.2
Washington	-20.6	-54.9
Atlanta	-19.2	-64.4
Boston	-17.6	-26.9
Milwaukee	-15.3	-24.3
Seattle	-7.3	-48.0
New York	-5.9	-3.6
San Francisco	-2.2	-18.8
Oakland	1.3	-36.0
Miami	22.9	-40.7
Los Angeles	40.6	-4.2

Source: Population data are from the County and City Data Book Consolidated File 1947-77 (tape), County and City Data Book 1983 (tape), and County and City Data Book 1994 (CD ROM).

Table 3
Ratios of City Per Capita Income to Suburban Per Capita Income
1960, 1990, and Change from 1960-1990

	1960	1990	Change 1960-90
Detroit	0.92	0.54	-41.6
Baltimore	0.91	0.64	-29.4
Oakland	1.02	0.75	-27.1
Milwaukee	0.85	0.63	-26.4
Miami	0.87	0.67	-23.0
Buffalo	0.89	0.69	-22.5
Cleveland	0.69	0.53	-22.5
Atlanta	1.14	0.89	-22.1
Philadelphia	0.83	0.65	-20.7
Minneapolis	1.08	0.86	-19.9
Chicago	0.82	0.66	-19.5
Cincinnati	1.01	0.82	-18.5
St. Louis	0.76	0.64	-16.3
Pittsburgh	1.02	0.88	-14.2
Washington	1.00	0.86	-14.1
San Francisco	0.95	0.82	-13.8
Seattle	1.18	1.03	-13.0
New York	0.75	0.68	-10.3
Boston	0.87	0.81	-6.7
Los Angeles	1.07	1.00	-6.1

Source: Income data are from the County and City Data Book Consolidated File 1947-77 (tape), County and City Data Book 1983 (tape), and County and City Data Book 1994 (CD ROM). All dollar values are deflated using the national CPI with 1982-4=100.

Table 4
House Values and the Size of
Tax Code-Related Subsidies for Housing

House Value	Value of Deduction	Value of Deduction as a percent of House Value
$20,000	$0	0.0%
$25,000	$0	0.0%
$35,000	$0	0.0%
$45,000	$0	0.0%
$55,000	$0	0.0%
$65,000	$0	0.0%
$75,000	$0	0.0%
$85,000	$141	0.2%
$95,000	$374	0.4%
$112,500	$781	0.7%
$137,500	$1,362	1.0%
$162,500	$2,747	1.7%
$187,500	$3,569	1.9%
$225,000	$4,802	2.1%
$275,000	$6,445	2.3%
$350,000	$8,910	2.5%
$450,000	$12,197	2.7%
$500,000	$13,840	2.8%

Table 5
Distribution of Owner-Occupied Homes by Price
Metropolitan Areas Only, Inside and Outside of Central Cities
1990

Total Owner-Occupied Homes in Metro Areas: 44,045,859
Owner-Occupied Homes in CCs of Metro Areas: 14,588,932
Owner Occupied Homes Outside CCs, Metro Areas: 29,456,927

	Central Cities			Outside Central Cities		
Home Price Ranges	# in Range	Percentage	Cumulative	# in Range	Percentage	Cumulative
<$20,000	591,186	4.1	4.1	465,891	1.6	1.6
$20,000-$29,999	823,806	5.6	9.7	651,505	2.2	3.8
$30,000-$39,999	1,270,521	8.7	18.4	1,153,439	3.9	7.7
$40,000-$49,999	1,490,195	10.2	28.6	1,706,889	5.8	13.5
$50,000-$59,999	1,463,435	10.0	38.7	2,082,127	7.1	20.6
$60,000-$69,999	1,448,369	9.9	48.6	2,450,430	8.3	28.9
$70,000-$79,999	1,204,672	8.3	56.8	2,443,166	8.3	37.2
$80,000-$89,999	921,292	6.3	63.2	2,097,099	7.1	44.3
$90,000-$99,999	740,000	5.1	68.2	1,857,961	6.3	50.6
$100,000-$124,999	1,073,677	7.4	75.6	3,109,044	10.6	61.2
$125,000-$149,999	784,544	5.4	81.0	2,581,582	8.8	69.9
$150,000-$174,999	604,012	4.1	85.1	2,079,698	7.1	77.0
$175,000-$199,999	460,717	3.2	88.3	1,550,566	5.3	82.3
$200,000-$249,999	588,717	4.0	92.3	1,894,954	6.4	88.7
$250,000-$299,999	383,578	2.6	94.9	1,167,916	4.0	92.7
$300,000-$399,999	362,124	2.5	97.4	1,099,998	3.7	96.4
$400,000-$499,999	154,511	1.1	98.5	456,855	1.6	97.9
$500,000+	223,814	1.5	100.0	607,806	2.1	100.0

Source: U.S. Census: *General Housing Characteristics* (CH-1-1).

Table 6: Annual Value of Subsidy/Tax Expenditures,
By Home Price and Location Within Metro Area*
(Assumptions as in Table A1)

Home Price Ranges	Central City	Outside Central City
<$20,000	$0	$0
$20,000-$29,999	$0	$0
$30,000-$39,999	$0	$0
$40,000-$49,999	$0	$0
$50,000-$59,999	$0	$0
$60,000-$69,999	$0	$0
$70,000-$79,999	$0	$0
$80,000-$89,999	$130,270,689	$296,529,799
$90,000-$99,999	$276,612,000	$694,505,822
$100,000-$124,999	$838,004,899	$2,426,608,842
$125,000-$149,999	$1,068,156,656	$3,514,823,893
$150,000-$174,999	$1,659,371,967	$5,713,450,331
$175,000-$199,999	$1,644,275,937	$5,533,892,526
$200,000-$249,999	$2,826,724,676	$9,098,621,631
$250,000-$299,999	$2,472,121,852	$7,527,101,828
$300,000-$399,999	$3,226,524,840	$9,800,982,180
$400,000-$499,999	$1,884,539,765	$5,572,169,064
$500,000+	$3,097,630,523	$8,412,156,601
Total	$19,124,233,803	$58,590,842,516

*These figures overstate the total tax expenditures because they are based on an 80 percent loan to value ratio, which exceeds the market average. Recall that total tax expenditures for the mortgage interest and property tax deductions was about $70 billion in 1996.

Table A1: Ownership-Related Deductions in Excess of the Standard Deduction

1	2	3	4	5	6	7	8	10
Home Prices	Mortgage Implied by 80% LTV	Interest Implied by 8.5% Interest Rate	Local Property Taxes Implied by 1.5% Effective Rate	Interest + Property Taxes	Interest + Property Taxes - Standard Deduction	Assumed Marginal Rate	Value of Excess Deductions for Assumed Tax Rate	First Year Excess Deductions as Percentage of Home Price
$20,000	$16,000	$1,360	$300	$1,660	($4,890)	0.15	$0	0.0%
$25,000	$20,000	$1,700	$375	$2,075	($4,475)	0.15	$0	0.0%
	$28,000	$2,380	$525	$2,905	($3,645)	0.15	$0	0.0%
$35,000								
$45,000	$36,000	$3,060	$675	$3,735	($2,815)	0.15	$0	0.0%
$55,000	$44,000	$3,740	$825	$4,565	($1,985)	0.15	$0	0.0%
$65,000	$52,000	$4,420	$975	$5,395	($1,155)	0.15	$0	0.0%
$75,000	$60,000	$5,100	$1,125	$6,225	($325)	0.28	$0	0.0%
$85,000	$68,000	$5,780	$1,275	$7,055	$505	0.28	$141	0.2%
$95,000	$76,000	$6,460	$1,425	$7,885	$1,335	0.28	$374	0.4%
$112,500	$90,000	$7,650	$1,688	$9,338	$2,788	0.28	$781	0.7%
$137,500	$110,000	$9,350	$2,063	$11,413	$4,863	0.28	$1,362	1.0%
$162,500	$130,000	$11,050	$2,438	$13,488	$6,938	0.396	$2,747	1.7%
$187,500	$150,000	$12,750	$2,813	$15,563	$9,013	0.396	$3,569	1.9%
$225,000	$180,000	$15,300	$3,375	$18,675	$12,125	0.396	$4,802	2.1%
$275,000	$220,000	$18,700	$4,125	$22,825	$16,275	0.396	$6,445	2.3%
$350,000	$280,000	$23,800	$5,250	$29,050	$22,500	0.396	$8,910	2.5%
$450,000	$360,000	$30,600	$6,750	$37,350	$30,800	0.396	$12,197	2.7%
$500,000	$400,000	$34,000	$7,500	$41,500	$34,950	0.396	$13,840	2.8%

Key Assumptions:
1. 80% loan-to-value ratio
2. 8.5% interest rate
3. 1.5% effective property tax rate
4. Owners are married couples with $6550 standard deduction applicable in 1995.