

Taxes and House Prices

Dennis R. Capozza
University of Michigan Business School
Ann Arbor, MI 48109
Capozza@umich.edu

Richard K. Green
School of Business
University of Wisconsin
Madison, WI
Rgreen@bus.wisc.edu

Patric H. Hendershott
Fisher College of Business
Ohio State University
Columbus, OH
Hendersh@cob.ohio-state.edu

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This research assesses the impact of income and property taxes on house prices using a decadal panel data set for 63 metropolitan areas from 1970 to 1990. Our evidence is consistent with full capitalization of marginal income tax rates into house prices. Full capitalization suggests that income tax changes have limited effects on the allocation of real capital among structure types, implying that past changes in the tax advantages have had little impact on home ownership and housing investment, in contrast to the conclusions of much of the existing literature. When we apply the results to some proposed tax changes, we compute substantial house price declines and wide geographic variation.

Economists have long recognized that owner-occupied housing is substantially tax advantaged in the U.S. owing to the nontaxation of the implicit rental income owners pay themselves and the low taxation of capital gains.¹ Traditionally, the literature has posited that these tax advantages raised the quantity of housing demanded (and consumed) and the ownership rate.² Analyzing 1960 data, Laidler (1969) estimated that the nontaxation of imputed rents raised the quantity of housing by 20 percent. Analyzing 1970 data using a more detailed and comprehensive methodology, Rosen (1979) obtained a similar result. He also estimated that nontaxation had raised the homeownership rate by five percentage points.³ These analyses lead to the general view that the tax caused substantial overinvestment in housing at the expense of investment in plant and equipment (Hendershott, 1987). Further, they imply that proposed base broadening and

¹ Some view the deductibility of interest and property taxes as subsidies, but if implicit rents were taxed, these would then be viewed as legitimate “business” expenses and thus appropriately deductible. Of course, eliminating these deductions would partially offset the advantage of the nontaxation of implicit rents and capital gains.

² These advantages also raise the demand for headship, which increases the demand for housing given the economies of scale in joint living (Haurin, Hendershott, and Kim, 1994).

³ In time series analysis, Rosen and Rosen (1980) obtained a similar quantitative impact.

accompanying reductions in tax rate schedules or the elimination of income taxes by a switch to a national sales tax would reduce ownership and the housing stock.

All the above analyses assumed an infinite supply elasticity of housing. Later analyses allowed for a positive elasticity, but with a moderate elasticity, the story changes little. When King (1980) used a supply price elasticity of two, the impact on housing consumption of the nontaxation of imputed rent was lowered by only about ten percent. Poterba (1984) estimated an even greater supply response, but still found that two-thirds of the impact was on quantity and emphasized the impact on the allocation of capital toward residential and away from nonresidential.

These earlier studies restrict their analysis to the housing structure and exclude the requirements of urban spatial equilibrium and capital market equilibrium. While the supply of residential structures is elastic, the supply of accessible residential land is not. We model the urban land and housing markets and impose asset pricing equilibrium conditions to demonstrate that the dominant impact of the housing subsidy is on price, not quantity.⁴ In the model a reduction in the tax advantage lowers house prices. The regional impact of a tax change varies across cities owing to differences in the level of income tax rates. The empirical tests of the model employs a particularly powerful panel data set derived from decennial censuses.

Full capitalization has broad implications for a number of issues in both housing economics and public finance. If changes in tax rates or in real after-tax interest rates are completely absorbed by changes in land prices, leaving the user cost of capital unchanged, then these tax changes have no impact on the quantity of housing demanded or on the allocation of capital among uses. If rents, too, are invariant to changes in the taxation of landlords, so that the effect is reflected solely in altered

⁴ Skinner (1996) reports aggregate data on real residential land and structure prices that illustrate the importance of distinguishing between land and structures. Between 1955 and 1993 real residential land prices rose at a 4 percent annual rate, while real structures prices declined at a 0.6 percent annual rate.

land values, then taxes also have little impact on rental housing demand or on home ownership.⁵

Consider a flat tax world where investors in owner-occupied housing capitalize the full benefit of the subsidy into higher real house prices. With a progressive tax system, inefficiencies may arise from actions of investors whose marginal tax rates are different from the marginal tax rate that is built into higher house prices. Households in higher tax brackets may “overinvest” in housing, driving down the value of implicit rents, while investors in lower tax brackets may under invest (although most such households would be renters). Even some of these inefficiencies may be eliminated; one could envision higher income households in a given MSA concentrating in particular areas and bidding up land values more than average.⁶

Numerous changes in the income tax code have been proposed, ranging from partial decrease in the value of deductions caused by a flatter tax rate schedule to a total elimination of deductions owing to a consumption tax. One concern with these proposals is the potential for a significant decline in house prices, a decline that should vary both across and within cities owing to differences in the level of income tax rates. This concern is justified; theoretical models posit large capitalization effects of tax benefits, and recent studies of metropolitan house prices are consistent with capitalization effects (Abraham and Hendershott, 1997).

These studies account only for federal taxes and do not allow any geographic variation in them. We compute average combined (federal and state) marginal tax

⁵ Blackley and Follain (1996) indicate only minuscule changes in rents in response to large shifts in the real after-tax required returns to rental housing investment during the 1970s and 1980s.

⁶While there may be few infra-asset distortions, Skinner (1996) argues that the high real house prices constitute an intergenerational transfer to the generation existing when the subsidy is capitalized from future generations that must save greater real amounts to purchase the same houses.

rates for 63 U.S. metropolitan statistical areas (MSAs) in the 1970, 1980 and 1990 census years using public use micro samples (PUMS). Owing to differences in average levels of both nominal incomes and state income tax rates, the geographic variation in these tax rates is large. Moreover, decadal changes in rates vary widely across MSAs.

We combine these tax rate data with the Capozza and Seguin (1996) data on rent, house price, property tax rates and other economic and demographic variables for these MSAs. For our analysis of taxation changes on house prices, we estimate combined time series cross section equations.⁷ We find that the income tax rate has a statistically and economically significant impact on house prices of the theoretically implied magnitude.

The model is presented and the results of earlier studies are interpreted in the next section. The data and estimates are reported in the third section. Simulated impacts of four alternative tax changes, including the substantial geographic variation in the impacts, are provided in section four. A final section summarizes and concludes.

Theory

Initial Model

In this section we provide the simplest model of urban land and housing markets that will illustrate the full capitalization result. The assumptions of this model are, of course, very strong. Therefore, in the next section we consider how weaker assumptions will affect the results.

Our point of departure is the model of a growing urban land market in Capozza and Helsley (1989). Here, since our purpose is to trace the impact of tax changes on house prices as well as land, we include housing production in the model, although

⁷We exclude New York City owing both to the widespread use of rent controls and a high local income tax rate. Riverside did not exist as an MSA in 1970, and it is not possible to measure the state income tax rate for Washington D.C. in 1970. Thus we have 187 observations.

initially we abstract from taxes. At time, t , there are $N(t)$ households in a small, open urban area. Each household demands one unit of housing which is produced using land and capital according to

$$H = \text{Min}[L, K] \quad (1)$$

where L is the quantity of land used in the production of housing and K is quantity of capital. That is, production of housing requires one unit of land and one unit of capital.⁸ The price of housing is then

$$P_H = P_L + P_K. \quad (2)$$

Given the above production conditions, the radius of the urban area will be determined by the total number of households, $N(t)$, according to

$$\pi \hat{x}(t)^2 = N(t) \quad (3)$$

where $\hat{x}(t)$ is the radius of the metro area at time t .

Each household earns income, Y , pays implicit net rent R to itself (all housing is owner-occupied) and commutes distance x at a cost of δx , where δ is the unit cost of commuting. In equilibrium households must be equally well off both within the urban area and among urban areas. Intraurban area equilibrium implies that no household can increase utility, $U(Y-R(x)-\delta x)$, by moving within the urban area or

$$R(x) = R(\hat{x}) + \delta(\hat{x}-x). \quad (4)$$

⁸ Without loss of generality, we are exploiting the degrees of freedom arising from the units of measurement of L and K , by setting the required production coefficients equal to one.

Interurban area equilibrium requires that income net of rent and transport costs in each metro area, $Y^i - R^i(0)$, be the same among urban areas, where superscript i indexes metro areas..

The price of housing equals the present value of expected net rental income,

$$P_H(x,t) = \int_t^{\infty} R(x,t) e^{-rt} dt = \frac{R(x,t)}{r-g^e} \quad (5)$$

where r is the discount rate and g^e is the expected growth rate of rents. The second equality assumes that the growth rate of rents is constant and perpetual. Because the risk-adjusted expected returns on all assets must be equal in equilibrium, the discount rate and total return on housing (rental rate plus expected capital gain) will equal yields on other comparable assets, i , in the absence of taxes. From (5),

$$r = \frac{R}{P_H} + g^e = i \quad (6)$$

where i is the return on a comparable risk bond.

If the urban area is growing at rate $2g$ so that $N(t) = N_0 e^{2gt}$, then using (2), (3) and (5),

$$P_H(x,t) = (\hat{P}_L + P_K - \frac{\delta}{r}x) + \frac{\delta \sqrt{\frac{N(t)}{\pi}}}{r-g} \quad (7)$$

where \hat{P}_L is the value of land at the edge of the urban area. The value of land at other locations is simply (from (2))

$$P_L(x,t) = P_H(x,t) - P_K. \quad (8)$$

Taxes

We now introduce income taxes to the model. In the case of owner-occupied housing, neither the net cash flow, R , i.e., the implicit net rents saved, nor the expected capital gains, dP_H , is taxed. On the other hand mortgage interest and property taxes are deductible. Thus, we rewrite the equilibrium return relationship for housing as:

$$r = \frac{R}{P_H} + g^e = i - t_y(i + t_p) \quad (6')$$

where t_y is the relevant income tax rate and t_p is the property tax rate.⁹ The $t_y(i + t_p)$ term in (6') is the tax subsidy to homeownership arising from the deductibility of interest and property taxes and the non-taxation of implicit rents.

The structure of the model is summarized in Figure 1. Housing rents are determined by city size and transportation costs in equation (4). The capitalization rate is determined in equation (6'). The value of housing then follows from equation (7) and land prices from equation (8). The income tax affects housing values only through its effect on the after tax required return, r . If the income tax rate, t_y , is reduced and the nominal pretax interest rate, i , does not change, the after tax required return will increase and house values will fall.

Notice that the effect of the income tax change does not depend on the assumption about the elasticity of the supply of capital, P_K , to housing. Indeed, as is often done, we can assume that the supply of housing capital is perfectly elastic so that P_K is a constant. In this perfectly elastic case the valuation effects are transmitted directly

⁹There is a long-standing debate over whether the net property tax rate should appear on the right side of equation (6') without adding the benefits provided by these taxes to the left side (and then canceling the two under the assumption that they are equal). We believe that when one is considering the marginal cost of purchasing another square foot of housing negligible benefits are obtained from the additional property taxes paid (schools are provided, trash is picked up, etc, independently of the size of the house) and thus the net property tax rate should appear on the right side of equation (6'). On the other hand, when one is considering a household's total housing or tenure decision, it seems reasonable to presume that the house purchase will provide services of value approximately equal to the property taxes paid.

to land values through equation (2). If the elasticity of housing capital is less than infinite, then the price of capital, P_K , will rise and moderate the increase in land prices. The price of housing, however, will still fully capitalize the tax change.

The full capitalization result also does not depend on the long run supply elasticity of housing. Because a household is by definition an occupied housing unit, the long run elasticity of supply implied by the model is (from (7))

$$\frac{dN}{dP_H} \frac{P_H}{N} = \frac{2(r-g)P_H}{\delta\sqrt{\pi N}}. \quad (9)$$

This elasticity decreases as the size of the urban area increases and increases as the value of accessibility, δ , declines. Notice that only in the extreme case of polycentric urban areas with no value to accessibility does the long run elasticity of supply become infinite since δ approaches zero. Plausible values for the parameters in (9) suggest long run supply elasticities substantially less than one.¹⁰ Elasticities for housing of this magnitude are much less than found in the older time series literature but consistent with recent estimates from panel data sets.

Nevertheless, the capitalization result does not depend on this housing supply elasticity in the model. The result arises because the number of households and the spatial equilibrium in equation (4) are not affected by changes in the income tax rate. Tax changes affect only the capitalization rate in (6') and confer windfall capital gains and losses on land owners but do not affect the demand for or supply of housing. Because homeowners are also the land owners, households bear the gains and losses.

Progressive income taxes

¹⁰See Blackley (1996) and Mayer and Sommerville (1997). We obtain comparable elasticities of 0.2 to 0.3 depending on functional form using our census data.

To extend the model, we now consider the case where there are two income groups and a progressive income tax law. Absent other frictions, if ownership of rental housing is not tax favored, both income groups will own, leaving no rental housing. The value of housing to the two income groups will differ according to the effect of their respective tax rates on equation (6'). Equalizing the tax rates of the two income groups to a marginal rate between the earlier rates will lower valuations for high income housing and raise those of low income housing.

During periods where the tax treatment of rental housing is especially tax favored, the high income group will both own and act as landlords for the low income group (see Titman, 1984). In this case the relevant marginal tax rate for valuing rental property is the high income rate. Because the tax rates are the same for owner occupied housing and for rental housing, reductions in the high income tax rate will reduce the valuations for both property types.

Margins of Adjustment

The model makes strong assumptions about the production and consumption of housing. It is important to ask whether weaker assumptions would affect the full capitalization result. First, the model assumes that consumption of housing depends on the rental cost alone. However, for owners who are wealth constrained, for example, first time home buyers, changes in the asset price will affect the consumption of housing. When tax increases cause house prices to rise, these constrained home buyers may rent or consume less housing. If so, price increases will be moderated slightly.¹¹

Second, the purchase of a home can be viewed as a prepurchase of future housing consumption plus a reversion value when the property is sold. Changes in property values do not affect future housing consumption because the service flow from the property is not affected by value fluctuations. However, there will be wealth effects

¹¹Linneman and Wachter (1989) find that households don't buy smaller houses but rather postpone ownership.

arising from the value changes, and these will be more important the closer a homeowner is to selling the property. This indirect effect on housing consumption is likely to be small because wealth effects in general are small and the possible realization of the change in value in the future will be discounted.

A third possible margin for adjustment is induced migration between metro areas. If tax changes affect some areas more than others, then some wealth constrained borrowers may be induced to migrate to low price areas when they would not have otherwise. This, too, is likely to be a small effect if the tax change is federal.

A fourth, and perhaps the most important, area where offsetting adjustments might occur is in the level of nominal interest rates. The model is partial equilibrium and does not address possible effects of tax changes on the return to capital (Atkinson and Stiglitz, 1980). We have assumed that nominal interest rates are exogenously fixed. This assumption is most consistent with an economy where capital is supplied from a world market and domestic tax changes do not significantly influence the worldwide return on capital. However, if tax changes are dramatic and/or the U.S is a dominant supplier of capital to the world market, nominal rates are likely to change in response to federal tax changes. For example, if interest rates fall in response to a policy change like the removal of the mortgage interest deduction, then the effect of the tax change on the after tax return in (6') will be moderated by the lower pretax interest rates.

Empirical Implications

Rent data are generally reported as gross rather than net. Rewriting (6') in terms of gross rents gives the following rental rate relationship,

$$\frac{R^g}{P_H} = (1 - t_y) i + (1 - t_y) t_p + m - g^e \quad (6'')$$

where gross rents are $R^g = R + mP_H + t_p P_H$. In the estimation of this equation, the maintenance rate, m , is treated as a constant. The equation suggests that the

estimated coefficients on the net interest rate, $(1-t_y)i$, and net property tax rate, $(1-t_y)t_p$, will be unity and that on expected housing capital gains will be negative unity. The measurement of these expected gains is, of course, problematic. The rent/price ratio will vary within and across MSAs owing to variation in the income and property tax rates and expected capital gains.¹²

The Data and the Estimates

The rent/price ratio is the median rent in the MSA divided by the median house price. Both of these series and the property tax rates are from census data. Property tax rates are available for 1980 only. We assume the same rates existed in 1970 and 1990.¹³ Thus, variation in the net property tax rate over time reflects variation in the income tax rate only. For the opportunity cost of investment in owner-occupied housing, we use the yield on long-term fixed-rate mortgages. This rate was 8.45 in 1970, 12.66 in 1980 and 10.05 in 1990 (FHLBB rates from the *Economic Report of the President*).

We test two proxies for expected house price appreciation. The first is predicted house price inflation from an OLS regression of metro area house price appreciation rates on actual population and income growth during each of the previous two decades, as well as decadal dummies.¹⁴ The second proxy is purely adaptive -- the actual appreciation rate in the MSA during the previous decade.

For the MSA income tax rate, we use the average marginal income tax rate for both owners and renters in the relevant MSA. Our computation of individual household federal and state marginal tax rates is based on two assumptions: the number of dependents equals all related individuals under age 18 in the household, and

¹² For evidence on the latter impact, see Capozza and Seguin (1996).

¹³ In 1990, the relevant property tax rate for California cities is the rate that a new buyer would pay and, given Proposition 13, this rate is much higher than the average actual tax rate being paid. Thus using the 1980 property tax rate for these cities is probably superior to using a 1990 rate (if one were available).

¹⁴ The adjusted R-squared, explaining appreciation over three decades (189 observations), is 0.27.

households do not itemize. The latter assumption is required by the data. The combined rate should be a good instrument for a household's actual marginal income tax rate, i.e., it should be highly correlated with this tax rate without being influenced by the variable we are attempting to explain, namely the rent/price ratio.¹⁵ While this procedure sets marginal tax rates at their maximum possible level, using renting and owning households in our census sample, which prevents an influence of the rent/price ratio, offsets the upward bias in tax rates.

The average marginal tax rates vary widely across MSAs and change significantly over time. Table 1 lists MSAs that were among the five highest and lowest in any of the three census years. The highest tax rate MSAs are found in California (three of the eight highest), Honolulu, Rochester, Washington, D.C., and two Midwestern cities, Milwaukee and Minneapolis. With one exception, Pittsburgh, the nine lowest tax localities are all in the South. The cross sectional differences are large. The average tax rate in the five highest tax MSAs is 50 to 75 percent greater than the average of those in the five lowest taxed MSAs in each of the three years.

These differences reflect MSA differences in both nominal income levels that cause federal taxes to differ and state tax rate schedules. To illustrate, the average federal, i.e., average marginal tax rate in the five highest tax rate MSAs in 1990 was 40 percent higher at 0.234 than that in the five lowest tax rate MSAs at 0.165. The average state tax rate in the highest five MSAs was 0.058 versus 0.0 in the five lowest (Florida, Tennessee and Texas have no state income tax).

Table 2 lists the five largest increases and decreases between the census years. On average, marginal tax rates declined: 0.008 between 1970 and 1980 or 3 percent and 0.018 or 7.5 percent between 1980 and 1990. Tax rate changes varied considerably across MSAs. The five largest declines averaged 0.042 and 0.045, respectively,

¹⁵The combined rate allows for deductibility of state income taxes, equaling the federal rate plus the state rate times one minus the federal rate.

during the two decades, changes of 15 to 20 percent. And during the 1970s, the five largest increases averaged 0.027 or more than 10 percent.

During the 1970s, the largest declines occurred in the low tax South. The largest increases were spread geographically. During the 1980s, four of the five largest declines occurred in MSAs that were among the seven highest tax MSAs in 1980, as one might expect given the sharp cut in marginal income tax rates for higher income households. The one exception is low tax Houston, where the impact of the oil price decline on incomes explains the tax rate drop. The largest increases were in West Palm Beach and Boston, where personal income per capita increased sharply relative to the rest of the country. The rise in Providence was due to modest increases in both federal and state tax rates. In contrast, the increases in Atlanta and Columbus resulted from large state tax increases that outweighed federal tax decreases.

The estimation of equation (6'') for our two measures of expected house price appreciation appears in Table 3. We cannot reject the hypothesized unity coefficients on the net mortgage and net property tax rates in either specification. In fact, the coefficients are within a half standard error of the expected unity value in three of four cases. The exception is the net mortgage rate in the equation with extrapolated expected inflation where the coefficient, 0.74, is 1.5 standard errors less than unity. The two expected inflation coefficients are negative and less than the expected negative unity value. The one based on extrapolative expectations is statistically significant.

We conclude that the asset-equilibrium model is strongly supported by our estimation.¹⁶ We use this model to infer geographic house price responses to four tax rate changes in the next section.

¹⁶ In addition to the direct test from equation (6''), the indirect test from equation (6''') also supports full capitalization of the income tax (see footnote 12 above).

Simulated House Price Responses

We compute the impact of four possible taxation changes: a 0.03 decrease in the average marginal federal tax rate, the elimination of the property tax deduction, the elimination of the mortgage interest deduction, and the equating of average marginal federal tax rates across regions, as a flat tax presumably would do, while maintaining the average-marginal federal tax rate constant. In the first three cases house prices decline in all MSAs. In the fourth case house prices decline in some MSAs and rise in others. The calculations are performed for all 63 MSAs.

To deduce the results equation (6') is rearranged to give the pricing relationship:

$$P_H = \frac{R}{i - t_y (i + t_p) - cg_H} \quad (10)$$

and we add the tax rate relation:

$$t_y = t_f + (1-t_f)t_s \quad (11)$$

where t_f and t_s are the federal and state average marginal values. We begin with a presentation of the results and then discuss some possible second order effects.

Direct Responses

Federal tax reduction--Taking the derivative of equation (10) with respect to the federal tax rate after substituting for t_y , we obtain

$$\frac{dP_H}{P_H} = \frac{(i + t_p)(1-t_s)}{R/P_H} dt_f. \quad (12)$$

The 1990 mortgage rate and mean values of the MSA property tax rates, average marginal state income tax rates, and R/P ratios, respectively, are 0.105, 0.014, 0.037, and 0.065. With a 0.03 decline in the federal tax rate, these values imply a 5.5 percent decline in real house prices.

MSAs with higher property taxes, lower state income taxes and lower rent/price ratios would experience larger price declines. MSAs with the reverse would see smaller declines. Of the 63 MSAs, 53 have price declines between 4.5 and 7.5 percent. The ten with greater price declines ranging up to 12.5 percent are listed in the first column of Table 4. These are generally high house price, low R/P MSAs: the California MSAs excluding Riverside, Honolulu, and four east coast MSAs (Boston, Hartford, Providence and Washington, D.C.).

Property tax deduction--Taking the derivative of equation (10) with respect to the rate at which property taxes are deducted and presuming that states would also disallow the deduction, we obtain

$$\frac{dP_H}{P_H} = - \frac{t_y t_p}{R/P_H}. \quad (13)$$

With a mean total average marginal tax rate of 0.22 in 1990 and the above other means, house prices are estimated to decline by 4.7 percent. MSAs with higher average marginal tax rates and property tax rates and lower rent/price ratios would experience greater price declines.

Here, 54 of the 63 MSAs are estimated to have price declines of one to six percent. The other nine listed in Table 5, have declines from seven to 15 percent. The three largest declines are from the four east coast cities in Table 4, Boston, Providence and Hartford. These have high property tax rates as well as low rent/price ratios. Eight of the nine MSAs listed in Table 5 have property tax rates above 2 percent, substantially greater than the 1.4 percent sample average.¹⁷

¹⁷Only three of the MSAs not listed in Table 5 have property tax rates in 1980 above 2 percent, Detroit, Grand Rapids, and Lansing. Michigan property tax rates were cut sharply in 1994.

Mortgage interest deduction--Taking the derivative of equation (10) with respect to the rate at which mortgage interest is deducted, allowing that deductibility is lost on only the debt financed portion of the house, we obtain,

$$\frac{dP_H}{P_H} = - \frac{t_y i LTV}{R/P_H} \quad (14)$$

where LTV is the loan-to-value ratio. In the U.S., the ratio of total home mortgage debt to the value of owner-occupied housing was 0.41 in 1992. Of course, if interest deductibility were removed, many households would use their marketable wealth invested in taxable assets to pay down their debt. An upper bound estimate of how far the LTV might decline can be gleaned from Australian data where mortgage interest has not been deductible for decades. Its country wide LTV in 1990 was 0.14. The calculated price declines for LTVs of 0.25 and 0.4, respectively, are 9 percent and 14 percent.

Assuming an average LTV of 0.25, 52 of the MSAs would experience price declines of seven to 11 percent. The 11 MSAs with greater declines are reported in the second column of Table 4 because the MSAs with the largest estimated price declines in response to a cut in federal tax rates or removal of interest deductibility are the same. In both cases, the high house price (low rent/price) MSAs are those expected to suffer the greatest declines, with Honolulu leading the list with a 23 percent drop.

Flat tax--The final simulation reports the impact of introducing an equal average marginal federal income tax rate in all 63 MSAs. The single federal rate that maintains the simple average of all prices equal to the 1990 MSA average is 19.3. Of the 63 MSAs, 51 are calculated to experience price changes ranging from -3.6 percent to +3.2 percent. The seven MSAs with (much) larger declines are listed at the top of Table 6; the five MSAs with larger price increases are reported at the bottom.

Not surprisingly, there is a close correspondence between the cities with the largest price declines and those listed in Table 1 as having the highest tax rates in 1990. Five of the six highest in Table 1 have the largest price declines if the marginal federal tax rates were equalized across MSAs. The correspondence also holds for price increases. The three lowest tax rate MSAs in 1990 are on the list of the five with the largest price increases. The correspondence between the tables is not perfect because Table 1 refers to the average combined federal and state marginal rate, not the federal rate alone.

Some Extensions and Caveats

The above results are partial equilibrium house price responses except where we allowed the LTV to respond to the loss of interest deductibility. However, these changes alter government revenues, which could cause offsetting tax rate changes and wealth effects. In fact, virtually all the other variables in equation (10), t_y , t_p , i , cg , and R , could respond.

How the government finances a general tax rate cut and how it uses tax revenues generated by the elimination of housing deductions matters. The most likely scenario would seem to be the matching of the two: a general tax rate cut financed by broadening the tax base via the reduction in housing-related deductions. If the government uses such revenues to finance a tax rate cut, then the reduction in house prices caused by the shrinkage of deductions will be magnified. The lower marginal tax rate will reduce the value of any housing-related deductions that might remain, as well as the value of the non-taxation of returns arising from equity financed owner-occupied housing.

Local governments, too, have a budget constraint. If we assume that property tax rates would be raised in response to the price declines so as to maintain a constant revenue flow, then $dt_p/t_p = -dP_H/P_H$. Allowing for this response changes the numerator in the above expressions from R/P_H to $R/P_H - (1-t_y)t_p$. That is the numerator is lowered from 0.065 to about 0.055 on average, which raises all the

estimated impacts by nearly a fifth. Of course the increase will be greater in high property tax rate MSAs (see Table 5) and less in others. Intuitively, a house price decline leads to a property tax rate increase, which magnifies the price decline.

House price declines could have further regional impacts. If the wealth declines reduce consumption, economic growth could slow for a period. As we noted earlier, real rent appreciation is related to real income growth, and real rent changes lead to similar real house price changes (see equation (2')). While it is reasonable to expect that the Federal Reserve would prevent a general economic decline, the Fed is not well equipped to offset regional impacts. Thus one might anticipate that the MSAs we predict to have the largest price declines will do even worse for a period, while MSAs with small predicted declines may not experience declines at all.

On the other hand, interest rates could decline in response to tax rate cuts. This would tend to dampen the house price decline, and the offset in an MSA would be proportional to the magnitude of the direct MSA price decline.

Summary and Conclusions

Conceptually, tax benefits for owner-occupied housing can translate into either greater housing consumption or higher real house prices. The existing public finance literature has emphasized the impact on consumption, arguing that the tax advantages have induced overinvestment in owner-occupied housing relative to business capital. This literature concentrates on the quite elastic construction response to increases in housing demand.

In contrast, our model illustrates that if housing and capital markets are competitive, urban spatial equilibrium in combination with capital market equilibrium imply that tax subsidies affect primarily the price of housing (land) rather than the quantity demanded. Two implications of the model are full capitalization of tax changes into house prices and the absence of a link between

taxes and rents. We provide empirical support for the former. The latter has been documented by earlier researchers..

Our empirical test of the model uses a powerful panel data set from 63 MSAs over three decades. The results support the hypothesis that tax benefits are fully capitalized into house values. Our empirical model differs from earlier research in a number of ways. The income tax rates incorporate state as well as federal tax schedules and allow for differences in nominal incomes across MSAs, owing to differences either in real incomes or relative price levels. In addition, property tax rates are included in the analysis.

With empirical support for the theoretical model and MSA specific data on tax rates and rent/price ratios, we are able to compute impacts of tax changes on house prices in individual MSAs. For example, both a three percentage point cut in marginal federal income tax rates and the removal of the property tax deduction are separately estimated to lower house prices by about 5 percent. If removal of the deduction is used to fund a tax rate cut, both forces are at work and the negative impact on house prices is greater. Further, if local governments raise property tax rates to offset the impact of the decline in house prices on their tax revenues, prices fall further.

The impact on house prices of removing the home mortgage interest deduction depends on the ability and willingness of households to use taxable asset holdings to pay down debt. If households are fully equity financing their houses, they retain the full benefit of the tax advantage to home ownership through the non-taxation of the income from implicit rents and nominal capital gains. The removal of the interest deduction, then, is irrelevant. Of course, most households are constrained from fully equity financing. With an average paid-down LTV of 25 percent, house prices should be expected to decline by nearly 10 percent, *ceteris paribus*.

Possibly more interesting than the average estimate of house price declines is the geographic variation in the estimates. For the removal of the property tax deduction, the declines are greater in high house price and high property tax MSAs. The decline is triple (15 percent) the average in Boston and double (10 percent) in Albany, Hartford and Providence. For the cut in the federal tax rate, the impact is less sensitive to the property tax, but is still more than 50 percent of the average in the nine lowest rent/price MSAs. For removal of the mortgage interest deduction, the impact is roughly double the average in four California MSAs and Honolulu.

The clearest implication of our strong regional effects is obtained when we equate the average marginal federal income tax rate across MSAs at a level such that the average house price change across all 63 MSAs is zero. Ten percent or greater declines are estimated in four California MSAs and Honolulu, while four percent or greater price increases are computed for five MSAs in the South.

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Table 1: MSAs with Highest and Lowest Average Marginal Tax Rates

	1990	1980	1970
Anaheim	0.27	0.32	0.29
Honolulu	0.28	0.28	0.30
Milwaukee	0.24	0.29	0.29
Minneapolis	0.26	0.32	0.30
Rochester	0.25	0.28	0.29
San Francisco	0.26	0.29	0.29
San Jose	0.28	0.31	0.30
Washington DC	0.28	0.30	NA
Mean Highest Five	0.27	0.30	0.30
Birmingham	0.21	0.22	0.20
El Paso	0.15	0.17	0.21
Knoxville	0.17	0.17	0.20
Memphis	0.18	0.19	0.21
Miami	0.18	0.19	0.21
Pittsburgh	0.20	0.23	0.20
San Antonio	0.17	0.18	0.20
Tampa-St. Pete	0.18	0.18	0.20
West Palm Beach	0.20	0.17	0.22
Mean Lowest Five	0.17	0.17	0.20

Table 2: Largest Changes in Average Marginal Tax Rates, 1970-80 and 1980-90

Largest Increases	1970-80		1980-90
Anaheim	0.034	Atlanta	0.004
Birmingham	0.026	Boston-Brockton	0.011
Grand Rapids	0.022	Columbus	0.005
Phoenix	0.030	Providence	0.010
Pittsburgh	0.024	West Palm Beach	0.022
Average	0.027	Average	0.010

Largest Declines	1970-80		1980-90
Albuquerque	-0.053	Anaheim	-0.051
Chattanooga	-0.044	Houston	-0.040
El Paso	-0.036	Milwaukee	-0.045
Jacksonville	-0.034	Minneapolis	-0.053
West Palm Beach	-0.041	San Jose	-0.038
Average	-0.042	Average	-0.045
Total Sample Average	-0.008		-0.018

Table 3: Estimation of Asset Equilibrium Model.

This table presents the results of estimates of equation (6') in which the dependent variable is the ratio of rent to price. Standard errors are in parentheses.

	Predicted House Price Inflation	Extrapolated House Price Inflation
Net Mortgage Rate	1.14 (0.24)	0.74 (0.18)
Net Property Tax Rate	1.09 (0.19)	0.97 (0.14)
Expected Appreciation	-1.8 (1.4)	-3.87 (0.32)
Year 1970	-0.36 (1.6)	2.5 (1.2)
Year 1980	-4.8 (2.4)	-0.34 (1.8)
Year 1990	-3.5 (1.9)	-0.13 (1.4)
Adjusted R-squared	42%	67%

Table 4: Simulated Percentage House Price Declines
 Computed for an interest rate equal to 10.05 percent and 1990 MSA specific values of
 tax rates and rent/price ratios.

	Federal Tax Rate Lowered by 0.03	Removal of Interest Deduction: LTV = 0.25
Anaheim	9.5	18.2
Boston	9.5	14.8
Hartford	9.6	16.0
Honolulu	12.5	23.2
Los Angeles	10.8	18.3
Providence	9.5	12.9
San Francisco	11.3	21.4
San Diego	9.0	15.7
San Jose	11.1	21.9
Seattle-Tacoma	7.6	12.9
Washington DC	8.0	15.7
Mean (63 MSAs)	6.2	9.8

Table 5: Percentage House Price Declines Owing to Removal of Property Tax Deduction

Metro Area	% Decline
Albany	9.4
Boston	15.4
Buffalo	7.4
Hartford	10.0
Philadelphia	7.4
Providence	10.6
Rochester	7.9
Syracuse	7.4
Washington, D.C.	7.4
Mean (63 MSAs)	4.5

Computed for an interest rate equal to 10.05 percent and 1990 MSA specific values of tax rates and rent/price ratios.

Table 6: Percentage House Price Changes in Response to Flat Average Marginal Federal Tax Rate (19.3 percent)

Largest Price Declines

Anaheim	11.1
Boston	8.6
Hartford	8.3
Honolulu	10.0
San Francisco	12.8
San Jose	15.2
Washington, D.C.	14.1

Largest Price Increases

Chattanooga	5.1
El Paso	7.5
Knoxville	4.0
New Orleans	5.2
San Antonio	4.2

Computed for an interest rate equal to 10.05 percent and 1990 MSA specific values of tax rates and rent/price ratios.

Figure 1
Model Structure

In the model spatial equilibrium conditions determine rents while capital market equilibrium provides interest rates which capitalize rents into prices. Land prices are then the residual of house prices minus structure costs.

