TAX POLICY AND HOUSE PRICE DYNAMICS

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THE U.S. NATIONAL HOUSING PRICE BOOM OVER the period from 2002 through 2005 worked to instill expectations that prices would continue to rise indefinitely. That has the effect of lowering the user cost of housing, thereby increasing demand for housing and putting additional upward pressure on housing prices. Additional demand came from existing homeowners who increased their demand for housing as well as from renters who switched their tenure status to become homeowners. At the same time, the anticipation of rising house prices among mortgage lenders reduced the perceived risk of relaxing mortgage qualification standards. Renters were offered riskier loans to buy houses, and mortgage originators and underwriters were willing to accommodate. A potential mortgage might have appeared risky using conventional underwriting standards based on the loan-to-value ratio and the income of the borrower, but with the expectation of continued rising house prices the perceived risk was reduced. Borrowers taking on loans with low temporary teaser interest rates expected that increases in house prices would enable them to refinance at favorable terms. Existing homeowners obtained cash-out refinancing based on the equity in their homes as well. If housing prices begin to fall, however, the user cost of housing rises and the dynamics of the housing market turn upside down. Demand is reduced via the linkages above, resulting in downward pressure on prices. The equilibrium is unstable and the market crashes. The bubble bursts.[1]

In this paper I examine the determinants of the user cost of housing, including house price inflation expectations and tax policy. I derive estimates of the user cost of housing for four U.S. metropolitan areas over the period 1995-2008 and I decompose those estimates into user cost component elasticities. In general, I find that the user cost tax elasticities are relatively small while the expected house price inflation elasticity is substantially larger and therefore plays a greater role in affecting housing market demand.

USER COST MODEL

The user cost model is the starting point from which to examine the potential role that tax policy had to play in the bursting of the housing price bubble. That model has been developed to explain the annual cost of ownership for owner-occupants.[2] Important in the computation of the annual cost of ownership is not only the tax advantages that come with ownership, but also the opportunity cost of equity tied up in the home. In order to capture all of the essential elements of the cost of ownership, the user cost model computes the imputed rent, or the implicit rent, paid by an owner-occupant. The properly computed financial return for an owner-occupied house is the value of the benefit of living in the house for a year, captured by the implicit rent, less the opportunity cost of capital, or the lost income that would have been received in the next best investment alternative. Hence, the net financial return incorporates differences in risk, tax benefits associated with owner-occupied housing, property taxes, maintenance and depreciation costs, and expected capital gains.

Following Poterba and Sinai (2008b), the imputed rent is comprised of seven components that capture both the costs and benefits of homeownership. User cost c is given as:

$$\textbf{(1)} \quad c = [1-\{\tau_d\rho+\tau_y(1-\rho)\}]r_T - \tau_d\rho(r_M - r_T) + (1-\tau_y)\beta + m + (1-\tau_d)\tau_p - \pi,$$

where τ_d is the income tax rate that applies to deductible property taxes and mortgage interest, τ_y is the income tax rate that applies to investment income, ρ is the loan-to-value ratio, r_M is the mortgage interest rate, r_T is the risk-free interest rate, β is the pretax risk premium, m is the maintenance and depreciation rate, and π is the expected rate of house price inflation (nominal). The user cost of housing in equation (1) represents the annual total cost of homeownership, per dollar of house value. Another way to view the user cost of housing is that it is simply the ratio of the implicit rental value per unit of housing capital to the asset price of a unit of housing capital: $c = R/p_H$.[3] This measure, when calculated at tax rates that correspond to the last dollar of investment income earned and last dollar of deductions for mortgage interest and property taxes, is the relevant marginal cost of housing for decisions on the purchase of additional housing.

The distinction between the income tax rate that applies to deductible property taxes and mortgage interest, τ_d, and the income tax rate that applies to investment income τ_y, allows for the fact that many homeowners do not itemize and therefore have no housing deductions. In that case $\tau_d = 0$ and the user cost expression in equation (1) simplifies to:

$$c = [1 - \{\tau_y(1-\rho)\}]r_T + (1-\tau_y)\beta + m + \tau_p - \pi.$$

Several aspects of tax law are not included in equation (1) for the sake of simplicity. First, this expression ignores potential capital gains taxation on a home. Since 1977 U.S. tax law provides that a joint return filing couple may qualify for a $500,000 exclusion of capital gain, as long as they have lived in the home at least two of the most recent five years prior to sale and meet other conditions.[4] Consequently, a large proportion of homes sold are not subject to capital gains taxation, or may only be partially subject to such taxation. Second, this expression ignores the fact that deductibility of mortgage interest is capped. Under current law, mortgage interest is deductible for mortgages up to $1,000,000. Finally, the model assumes that homeowners do not receive any benefits from the property taxes they pay. If we were to take a benefits view of the property tax and include the value of the benefits received, the user cost expression would need modification as in Poterba and Sinai (2008b).

In the user cost equation (1), we see that while user cost is typically considered to be strictly positive, it is possible for user cost to be negative. That can happen in two ways. First, the term $\tau_d \rho (r_M - r_T)$ may be negative. This occurs in the situation where the risk-free interest rate exceeds the mortgage interest rate, which does not occur in properly functioning mortgage markets. Second, the rate of expected house price inflation π may be positive and large enough to make the user cost expression negative. This may certainly happen, and has in some recent U.S. housing markets prior to the bursting of the housing asset bubble.

COMPARATIVE STATICS

It is important to examine how changes in the parameters of the model affect the user cost of housing, and thereby affect the demand for housing. Consider first the effect of a change in the marginal tax rate that applies to housing deductions. If that owner itemizes, an increase in the tax rate reduces the user cost of housing. The reason is that more of the interest paid on the mortgage is deducted as the tax rate rises. This relationship is captured in the derivative and the corresponding elasticity,

$$\textbf{(2)}\quad \frac{\partial c}{\partial \tau_d} = -(\rho r_M + \tau_p) < 0,\ \varepsilon_{\tau_d} = -\frac{(\rho r_M + \tau_p)\tau_d}{c}.$$

The loan-to-value ratio is clearly influential in this relationship. The higher the ratio, the larger the mortgage relative to the price of the house, the stronger is the negative effect of deductibility. In the extreme case where there is no mortgage, the derivative collapses to be $-\tau_p$, simply capturing the deductibility of the property tax.

An increase in the property tax rate has the effect of increasing the implicit rental price, and thereby the user cost of housing, for an itemizer. The derivative and elasticity are given as,

$$\textbf{(3)}\quad \frac{\partial c}{\partial \tau_p} = (1-\tau_d) > 0,\ \ \varepsilon_{\tau_p} = \frac{(1-\tau_d)\tau_p}{c}.$$

Since this derivative is strictly positive, we know that the property tax rate and user cost of housing are directly related. The size of the property tax impact on user cost clearly depends on the marginal tax rate of the homeowner that applies to income tax deductibility. This, in turn, depends on the taxable income level of the homeowner.

A change in the income tax rate that applies to investment income has an ambiguous effect on user cost, as seen in the derivative and the corresponding elasticity,

$$\textbf{(4)}\quad \frac{\partial c}{\partial \tau_y} = (1-\rho)r_T - \beta,\ \ \varepsilon_{\tau_y} = \frac{\{(1-\rho)r_T - \beta\}\tau_y}{c}.$$

The sign of this derivative depends on the relative sizes of the two terms. In the case where the house has no mortgage and $\rho = 0$, the sign depends on the relative sizes of the risk-free interest rate and the pretax risk premium. Otherwise, the sign also depends on the loan-to-value ratio as it reduces the risk-free interest rate.

The loan-to-value ratio has an ambiguous effect on the user cost of housing as seen in the derivative and elasticity,

$$\textbf{(5)}\quad \frac{\partial c}{\partial p} = \tau_y r_T - \tau_d r_M \gtrless 0,\ \ \varepsilon_{\rho} = \frac{(\tau_y r_T - \tau_d r_M)\rho}{c}.$$

The derivative may be positive, zero, or negative, depending on the parameter values.

The maintenance rate has a direct (positive) and proportional effect on the user cost of housing, as demonstrated by the strictly positive unitary derivative,

(6) $$\frac{\partial c}{\partial m} = 1 > 0,\ \varepsilon_m = \frac{m}{c}.$$

An increase in the pretax risk premium has the effect of raising the user cost of housing as seen in the derivative and elasticity,

(7) $$\frac{\partial c}{\partial \beta} = (1-\tau_y) > 0,\ \varepsilon_\beta = \frac{(1-\tau_y)\beta}{c}.$$

The greater the risk premium, the greater the user cost of owning a house.

The effect of an increase in the risk-free interest rate is also to increase the user cost of housing. The appropriate derivative and elasticity are given by,

(8) $$\frac{\partial c}{\partial r_T} = [1-\{\tau_d\rho + \tau_y(1-\rho)\}] + \tau_d\rho > 0,$$
$$\varepsilon_{r_T} = \frac{[1-\{\tau_d\rho + \tau_y(1-\rho)\}]r_T}{c}.$$

The size of this effect, however, is dependent upon the tax rate that applies to deductible housing expenses, the tax rate that applies to investment income, and the loan-to-value ratio.

An increase in the mortgage interest rate paid by the homeowner has the effect of reducing the user cost of housing, shown in the following derivative and elasticity,

(9) $$\frac{\partial c}{\partial r_M} = -\tau_d\rho < 0,\ \varepsilon_{r_M} = -\frac{(\tau_d\rho)r_M}{c}.$$

Finally, the expected rate of house price appreciation has an inverse (negative) effect on the implicit rental price of housing. The derivative and elasticity with respect to the expected nominal house price inflation rate are given by,

(10) $$\frac{\partial c}{\partial \pi} = -1 < 0,\ \varepsilon_\pi = -\frac{\pi}{c}.$$

Hence, as house price inflation increases (decreases), the user cost of housing falls (rises). More relevant to recent experience, we should note that as house price deflation accelerates the user cost of housing rises, and can do so dramatically as we will see. As the user cost of housing rises, households wish to move up their demand curves for housing and consume less housing.

DECOMPOSING CHANGES IN USER COST

We can decompose changes in user cost into its constituent components, by taking the total differential of user cost *c:*

(11) $$dc = \frac{\partial c}{\partial \tau_d}d\tau_d + \frac{\partial c}{\partial \tau_p}d\tau_p + \frac{\partial c}{\partial \tau_y}d\tau_y + \frac{\partial c}{\partial m}dm + \frac{\partial c}{\partial \rho}d\rho + \frac{\partial c}{\partial \beta}d\beta + \frac{\partial c}{\partial r_T}dr_T + \frac{\partial c}{\partial r_M}dr_M + \frac{\partial c}{\partial \pi}d\pi.$$

This expression illustrates how changes in user cost are determined by changes in the nine factors from which *c* is composed. If we were to take the total derivative of *c* with respect to time, for example, the total derivative would be the sum of the nine factor changes times their respective *c* partial derivatives. In elasticity form, equation (11) would indicate that the elasticity of user cost with respect to time is the sum of nine products, each of which is itself the product of the partial elasticity of *c* with respect to a *c*-determining factor (the nine elasticities reported in Table 1) and the elasticity of that factor with respect to time.

In the following section we estimate both user cost and its elasticities with respect to the nine determining factors for a selection of four U.S. cities. In so doing, I follow Poterba and Sinai (2008a) in defining the pretax cost of funds as the risk-free medium-term interest rate including a risk premium. They use the 10-year Treasury bond rate r_T plus a risk premium of 200 basis points. Poterba and Sinai also assume that the maintenance rate is $m = 0.025$. Rather than using the Poterba and Sinai national average property tax rate $\tau_p = 0.0104$, I use the National Association of Home Builders (NAHB, 2009) effective property tax rates for the relevant PMSAs. These data are from the 2000 Census of Population and Housing, U.S. Census Bureau.

A key issue in estimating user cost is the expected nominal house price inflation term π. Himmelberg, Mayer and Sinai (2005, p. 77) say that this term is, "…one of the most critical and least understood determinants of the user cost of housing." Indeed, the expected home price appreciation issue was central to the debate over the existence of a housing asset bubble in the early 2000s. The higher the expected rate of house price inflation, the lower the user cost. This fact has an impact on the derivatives and elasticities of user

Table 1
User Cost Elasticities

Year	ε_{τ_d}	ε_{τ_F}	ε_{τ_y}	ε_m	ε_c	ε_β	ε_{τ_T}	ε_{τ_M}	ε_π
Baltimore-Towson User Cost Elasticities									
1995	-0.085	0.092	0.041	0.253	-0.011	0.162	0.530	-0.062	-0.025
1996	-0.087	0.095	0.041	0.262	-0.011	0.168	0.539	-0.063	-0.052
1997	-0.089	0.100	0.042	0.274	-0.011	0.176	0.557	-0.064	-0.096
1998	-0.118	0.141	0.038	0.387	-0.020	0.248	0.651	-0.083	-0.407
1999	-0.272	0.310	0.099	0.851	-0.047	0.544	1.529	-0.195	-2.186
2000	-0.277	0.297	0.111	0.815	-0.051	0.522	1.570	-0.203	-2.152
2001	2.981	-3.545	-0.839	-9.734	0.589	-6.230	-15.609	2.095	35.528
2002	0.181	-0.225	-0.040	-0.617	0.037	-0.395	-0.905	0.124	3.105
2003	0.102	-0.137	-0.014	-0.377	0.021	-0.241	-0.483	0.068	2.218
2004	0.070	-0.095	-0.013	-0.260	0.013	-0.166	-0.355	0.047	1.863
2005	0.063	-0.085	-0.012	-0.232	0.011	-0.149	-0.319	0.042	1.773
2006	0.919	-1.159	-0.239	-3.181	0.159	-2.036	-4.872	0.630	12.089
2007	-0.114	0.145	0.027	0.397	-0.021	0.254	0.587	-0.078	-0.361
2008	-0.050	0.066	0.003	0.182	-0.013	0.116	0.212	-0.034	0.437
Dallas-Plano-Irving User Cost Elasticities									
1995	-0.106	0.149	0.045	0.279	-0.012	0.178	0.584	-0.068	-0.178
1996	-0.125	0.179	0.052	0.335	-0.014	0.214	0.688	-0.081	-0.401
1997	-0.122	0.177	0.050	0.330	-0.013	0.211	0.671	-0.077	-0.377
1998	-0.238	0.366	0.067	0.684	-0.036	0.438	1.148	-0.147	-1.600
1999	-0.314	0.463	0.100	0.864	-0.048	0.553	1.553	-0.198	-2.386
2000	-0.331	0.462	0.117	0.864	-0.054	0.553	1.663	-0.215	-2.488
2001	-0.241	0.370	0.059	0.690	-0.042	0.442	1.107	-0.149	-1.567
2002	-0.151	0.241	0.029	0.450	-0.027	0.288	0.660	-0.091	-0.612
2003	-0.113	0.193	0.013	0.361	-0.020	0.231	0.462	-0.065	-0.227
2004	-0.123	0.209	0.019	0.390	-0.019	0.250	0.533	-0.070	-0.363
2005	-0.155	0.264	0.025	0.493	-0.024	0.315	0.676	-0.089	-0.725
2006	-0.157	0.253	0.035	0.472	-0.024	0.302	0.724	-0.093	-0.727
2007	-0.133	0.216	0.027	0.403	-0.021	0.258	0.596	-0.079	-0.451
2008	-0.124	0.208	0.007	0.388	-0.029	0.248	0.452	-0.072	-0.268
Phoenix-Mesa-Scottsdale User Cost Elasticities									
1995	-0.198	0.150	0.106	0.657	-0.028	0.421	1.378	-0.161	-1.578
1996	-0.178	0.136	0.093	0.598	-0.025	0.383	1.230	-0.144	-1.322
1997	-0.146	0.115	0.076	0.503	-0.019	0.322	1.020	-0.118	-0.940
1998	-0.267	0.225	0.096	0.985	-0.052	0.631	1.655	-0.211	-2.444
1999	-0.353	0.281	0.143	1.235	-0.069	0.791	2.220	-0.283	-3.459
2000	-0.275	0.205	0.122	0.901	-0.057	0.576	1.734	-0.224	-2.360
2001	-0.264	0.221	0.084	0.970	-0.059	0.621	1.555	-0.209	-2.309
2002	-0.222	0.196	0.056	0.859	-0.052	0.550	1.260	-0.173	-1.813
2003	-1.784	1.719	0.276	7.545	-0.422	4.829	9.662	-1.354	-22.332
2004	0.111	-0.106	-0.023	-0.466	0.023	-0.298	-0.636	0.084	2.485
2005	0.023	-0.022	-0.005	-0.097	0.005	-0.062	-0.133	0.018	1.310
2006	0.072	-0.064	-0.021	-0.282	0.014	-0.180	-0.431	0.056	1.943
2007	-0.055	0.050	0.015	0.218	-0.012	0.140	0.323	-0.043	0.281
2008	-0.022	0.021	0.002	0.092	-0.007	0.059	0.107	-0.017	0.728
Warren-Troy-Farmington Hills User Cost Elasticities									
1995	-0.353	0.418	0.164	1.015	-0.043	0.650	2.128	-0.249	-3.167
1996	-0.607	0.728	0.275	1.768	-0.075	1.131	3.636	-0.426	-6.188
1997	-0.295	0.360	0.133	0.875	-0.034	0.560	1.776	-0.205	-2.537
1998	-0.378	0.491	0.117	1.193	-0.062	0.763	2.003	-0.256	-3.387
1999	-0.360	0.446	0.126	1.083	-0.060	0.693	1.947	-0.248	-3.109
2000	-0.300	0.351	0.115	0.852	-0.054	0.545	1.640	-0.212	-2.334
2001	-0.213	0.275	0.058	0.669	-0.040	0.428	1.073	-0.144	-1.405
2002	-0.168	0.228	0.036	0.553	-0.033	0.354	0.811	-0.112	-0.913
2003	-0.137	0.200	0.018	0.486	-0.027	0.311	0.623	-0.087	-0.593
2004	-0.145	0.210	0.025	0.511	-0.025	0.327	0.697	-0.092	-0.720
2005	-0.104	0.151	0.019	0.367	-0.018	0.235	0.503	-0.066	-0.239
2006	-0.058	0.080	0.015	0.194	-0.010	0.124	0.297	-0.038	0.316
2007	-0.041	0.057	0.009	0.139	-0.007	0.089	0.205	-0.027	0.518
2008	-0.031	0.044	0.002	0.107	-0.008	0.068	0.125	-0.020	0.664

cost with respect to other parameters in the model. In the user cost and elasticity estimations that follow in this paper, I use the geometric mean of the most recent four quarter values of the four quarter (price change vs. same quarter a year earlier) appreciation rates for the purchase-only OFHEO index for each metropolitan area. This is admittedly a short horizon view of the expected rate of house price appreciation or depreciation. In reality, many homeowners are probably not so sensitive to transitory changes in house price inflation. Yet, homeowners in the early years of an adjustable rate mortgage may indeed be very sensitive owing to the fact that they are planning to refinance within the first several years of their mortgage, before the scheduled reset of their mortgage rate. Nevertheless, this approach gives us a very dynamic view of changes in user cost over time, and thereby gives us the opportunity to see how user cost elasticities are also changing dynamically. I have also examined the use of 20 quarter moving averages of OFHEO price index changes in several cases. Those results provide similar user cost patterns over time, although the smoothing of the house price inflation series results in a dampened pattern of user cost changes over time. The smoothing does not, however, prevent user cost from going negative in those cases.

FOUR-CITY USER COST ESTIMATIONS

In order to illustrate user cost dynamics and the decomposition of user cost changes into its component elasticities, I compute these entities for a set of four U.S. cities which are broadly representative of recent housing market experiences across metropolitan areas. The Baltimore-Towson metro area is representative of many east coast cities where house prices measured by the OFHEO house price index rose steadily during the 1990s and early 2000s, then fell precipitously in the mid 2000s, crossing into negative territory with prices falling. The case of Dallas-Plano-Irving is a bit different where the OFHEO price index rose over the period 1995-2000, fell over the period 2000-2003, but never crossed into negative territory, then rose again. The Phoenix-Scottsdale case illustrates one of the urban areas hit hardest by the bursting of the housing price bubble. The Phoenix OFHEO price index shows that house prices were relatively flat over the period 1995-2003, rose dramatically in 2003-2004, then fell alarmingly in 2005-2006. The case of Warren-Troy-Farmington Hills in metropolitan Detroit reflects a declining urban area over the entire time period, with the OFHEO index rate of inflation declining over the period 1995-2005, followed by sharply falling prices.

Figure 1 illustrates the estimated user cost of housing for the Baltimore-Towson metro area over the period 1995-2008. While user cost started in the range of 0.10 in the mid-1990s, it fell over the latter half of the 1990s and crossed into negative territory in 2001. User cost stayed in negative territory until 2006 when it rose sharply over the period 2006-2008. The estimated Baltimore-Towson elasticities of user cost are provided in Table 1. The tax elasticities in the first three columns of the table are generally of the expected sign and are less than unity in absolute value, with several notable exceptions. All three tax elasticities switch sign during the period 2001-2006. The deductible income tax elasticity is negative unless user cost is negative. In that case, the elasticity turns positive as it was in Baltimore-Towson over the period 2001-2006. The elasticity exceeded unity in absolute value in 2001 and approached unity in 2006, the two periods at the beginning and end of the negative user cost era. In a similar way, the property tax rate elasticity changed sign from positive to negative during the period 2001-2006 and exceeded unity in absolute value in 2001 and 2006. Finally, the investment income tax elasticity switched sign from positive to negative during the period 2001-2006. This elasticity was less than unity in absolute value throughout the entire estimation period, however. User cost in Baltimore-Towson is generally not very responsive to the tax rates, as indicated by these estimated user cost elasticities with respect to tax rates. It is relatively more responsive to the property tax rate and least responsive to the investment income tax rate.

Among the other factors affecting user cost, the estimates in Table 1 indicate that user cost is relatively unresponsive to the loan-to-value ratio and the mortgage rate of interest. User cost is more responsive to the risk-free interest rate and the expected rate of house price inflation. Indeed, the consistently largest elasticities are found in the case of the expected rate of house price inflation during the period where user cost is negative.

The pattern of elasticities exceeding unity in the years coinciding with user cost sign changes simply reflects the fact that the elasticities each have user cost in the denominator. As user cost declines and approaches zero, from above or below, the elasticity blows up.

Figure 1: **Baltimore-Towson User Cost**

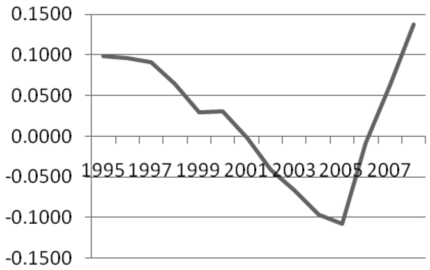


Figure 2 : **Dallas-Plano-Irving User Cost**

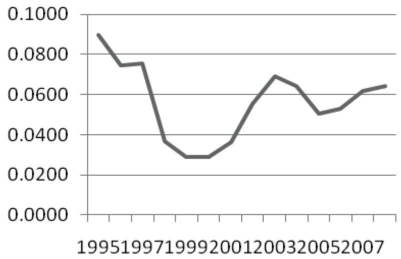


Figure 3: **Phoenix-Mesa-Scottsdale User Cost**

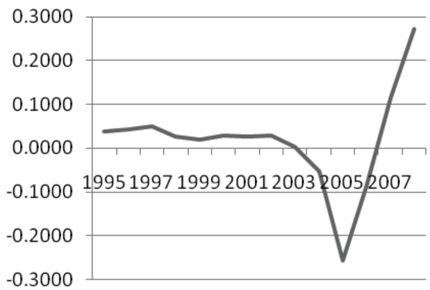
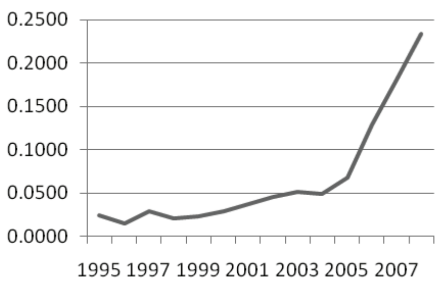


Figure 4: **Warren-Troy-Farmington Hills User Cost**



In the case of Dallas-Plano-Irving, illustrated in Figure 2, the user cost of housing was at its peak of 9 percent 1995 and fell to a low of 3 percent over the period 1996-2000. User cost then rose over the period 2001-2003 to approximately 7 percent and then stabilized at approximately 6 percent over the period 2004-2008. The estimated tax elasticities of user cost are all less than unity in absolute value. The deductible income tax rate elasticity is uniformly less than unity in absolute value, and generally lies in the range of 0.1 to 0.3, reflecting an inelastic response of user cost. The property tax elasticity is positive and is similarly less than unity but is somewhat larger than the deductibility tax rate elasticity. The investment income tax rate elasticity is also positive and quite inelastic.

Among the remaining elasticities, the maintenance elasticity is inelastic, the loan-to-value ratio elasticity is quite small across all years, the pretax risk premium elasticity is less than unity throughout, the risk-free interest rate elasticity is generally inelastic with the exception that it exceeds unity during the period 1998-2001, and the mortgage interest rate elasticity is quite small over the entire period of time. Finally, the house price inflation elasticity is negative throughout, and exceeds unity during the period 1998-2001 when the user cost was very small.

Phoenix-Scottsdale, illustrated in Figure 3, is one of the urban areas hit hardest by the bursting of the housing price bubble. User cost was a steady 5 percent or less over the period 1995-2002. Then user cost fell sharply and turned negative over the period 2003-2005. It rose sharply in 2006 and turned positive in 2007-2008. Viewing the estimated user cost elasticities in Table 1, similar tax elasticity patterns as in the Baltimore-Towson case are evident, although at an amplified rate. The tax elasticities are generally small, indicating relatively unresponsiveness of user cost to the tax rates. The two striking results in the table are the risk-free interest rate elasticities and expected house price elasticities. In both cases, the estimated elasticities are frequently greater than unity in absolute value indicating that user cost is quite sensitive to these factors in Phoenix-Scottsdale.

User cost of housing was rising modestly over the period 1995-2004 in Warren-Troy-Farmington Hills, illustrated in Figure 4, but then rose sharply over the period 2005-2008. The usual user cost elasticity patterns we have observed in the previous three cities apply here as well. The tax elasticities are less than unity in absolute value throughout. The notable results in this case are the large elasticities for the risk-free interest rate and the expected rate of house price inflation during the period 1995-2001.

SUMMARY AND CONCLUSIONS

In this paper I have analyzed the user cost of housing with a focus on decomposing changes in user cost into its constituent components. Among those components are three tax rates that affect user cost, including the tax rate that applies to housing deductions, the tax rate that applies to investment income, and the property tax rate. Other factors affecting user cost include the loan-to-value ratio, the mortgage interest rate, the risk-free interest rate, the pretax risk premium, the maintenance and depreciation rate, and the expected rate of nominal house price inflation. Using data over the period 1995-2008 for four representative U.S. cities, I estimate user cost and the elasticities of user cost with respect to each of these determinants. Interestingly, I find that the user cost of housing fell sharply in several cities prior to the bursting of the housing asset bubble due to the high level of expected house price inflation. The largest elasticity estimates among the four cities over this period of time are the house price elasticities. In general, the tax rate elasticities are relatively small in absolute value, indicating that user cost is not highly sensitive to the tax rates. Hence, in general the dynamics of user cost changes have been driven more by changes in house price inflation and deflation than by any changes in tax rates, whether federal income tax rates or local property tax rates.

There are several limitations inherent in the analysis of this paper. First, it would be good to simulate alternative estimates of the expected nominal rate of house price appreciation or depreciation. A range of rates from relatively short- to long-time horizons would provide a robustness check on the estimated user cost and associated elasticities. Second, it would be much better to use effective local property tax rates for each year, rather than one estimate based on the 2000 census. This would introduce much needed variation in the local tax rates that may result in finding a greater sensitivity of user cost to the local property tax rate. Availability of such data is problematic, however. Third, it would be better to use local or regional mortgage interest rates rather than a uniform national rate. Finally, the assumption of a fixed risk premium is *ad hoc* and should be replaced by a more sophisticated way of incorporating risk in the model.

Despite these limitations, however, the user cost model and its comparative statics provide important insights into the dramatically changing housing markets in recent years. With additional refinement this model is capable of even more insight. Indeed, such insight is crucial as we move to re-establish rationality in housing markets. Shiller (2009, p. 2) ends his brief litany of unlearned lessons from the housing bubble by saying, "The sobering truth is that the current world economic crisis was substantially caused by the collapse of speculative bubbles in real estate (and stock) markets—bubbles that were made possible by widespread misunderstandings of the factors influencing prices." Research in the field must push forward to understand these factors more fully.

Notes

1 See Case and Shiller (2003) for a good summary of the housing bubble argument.

2 See Hendershott and Slemrod (1983), Poterba (1992), Poterba and Sinai (2008a, 2008b), and Quigley (1998) for various versions of the basic user cost model.

3 Alternatively, we can rearrange this equation to indicate that the implicit rental value of a house is the user cost times the price of the house: $R = cP_H$. Another way of expressing this relationship is to show that the ratio of the price house to its implicit rental value is the inverse of the user cost of housing: $P_H/R = 1/c$.

4 See U.S. Department of the Treasury (2008) for further details.

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