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The tax treatment of housing is a central issue of income tax design. The United States tax code, which allows homeowners to deduct mortgage interest and property taxes but does not tax their imputed rental income, provides a substantial subsidy to owner-occupied housing relative to other consumption goods. The Canadian tax code resembles the U.S. code in not taxing imputed income, but Canadian taxpayers cannot deduct mortgage interest or property tax payments. Both tax systems provide important tax relief on housing capital gains. Canadian households are not taxed on capital gains on owner-occupied housing, while U.S. households are eligible for a one-time \$125,000 tax exemption.

This paper presents a framework for analyzing how the tax and economic changes of the last decade have affected households' marginal incentives to consume owner-occupied housing. Tax rules toward housing interact with other tax provisions such as the level of marginal tax rates, as well as with macroeconomic conditions such as inflation, to determine the net cost of owner occupation. Two aspects of the tax system are important in this regard. The first is the relative tax burden on housing in comparison with other portfolio assets. A high burden on housing capital will reduce housing consumption. The second is the relative tax burden on housing services and other consumption goods. High excise taxes on other goods will induce households to consume housing services.

The paper is divided into four sections. The first describes the basic tax

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rules that affect owner-occupied housing investment in Canada and the United States. In Canada, the tax system has no direct effect on the user cost of home ownership for many households. Rather, its effects operate through the burdens placed on other assets and other goods. The second section presents background data on the housing markets in the two nations. Broad comparisons of the home ownership rate and the size of the housing capital stock are useful, because they shed light on the potential effects of the different tax rules. While there is some evidence that the United States is more housing-capital-intensive than Canada, the home ownership rates in the two nations are similar. The third section outlines a simple asset-market model of housing investment and consumption, and discusses recent evidence on the applicability of this model to the housing market. The fourth section calibrates this model using time series data for each country, and contrasts the resulting parameters with those from earlier studies of the United States. The fifth section uses this model to estimate how housing prices and the demand for owner-occupied housing would respond to the tax and interest rate changes of the last decade, assuming all other factors were held constant. The concluding section notes several important limitations of the simple asset-price model and suggests extensions that could address these problems.

9.1 The Tax Treatment of Housing: Canada and the United States

This section begins with a brief summary of the user-cost approach to measuring housing costs, and then describes the principal tax provisions in both nations that affect user costs. It concludes by noting other features of the policy environment, principally financial policies, that affect the cost of housing.

9.1.1 The User Cost of Home Ownership: Canada

The user cost of home ownership measures the marginal cost of an incremental unit of owner-occupied housing. It reflects both cash outlays within the year and the foregone return on the owner's equity. The most convenient assumption for computing the user cost is that property taxes (τ_p), physical decay (δ), and the cost of home maintenance (m) are all constant fractions of house value. In addition, all households are assumed to borrow and lend at a pretax interest rate i , to expect house price appreciation at rate π_r , and to require a risk premium of α to invest in housing. The real purchase price per unit of owner-occupied housing is set equal to P_o .

A central issue in modeling the user cost for Canadian households involves the tax treatment of returns on alternative assets. These assets determine the opportunity cost of investing funds in housing capital. Given the widespread availability of Registered Retirement Saving Plans (RRSPs) and other tax-deferred saving vehicles, the benchmark assumption is that returns on other assets are untaxed. Investors' after-tax returns equal their before-tax returns.

The user cost of owner-occupied housing for a Canadian household is therefore

$$(1) \quad c_{o.Can} = [i + \tau_p + \delta + \alpha + m - \pi_e]P_o.$$

By subtracting expected house price inflation from the nominal interest cost, this expression recognizes that housing capital gains are untaxed.

Households with constraints on other tax-deferred saving face a different user cost. During 1974–85, they also derived additional housing incentives from a subsidized saving plan, the Registered Homeownership Saving Program (RHSP), that effectively reduced the price of home purchase for first-time home buyers. This program enabled first-time buyers to contribute \$1000 per year, up to a maximum of \$10,000, to an account for use in financing home purchase. For households with unused capacity to contribute to other tax-deferred saving accounts, the RHSP program did not affect the user cost of housing. For households facing constraints on other tax-deferred contributions, however, the RHSP did lower the cost of housing. This program transformed one dollar of after-tax income into more than one dollar, provided the funds were used for house purchase.

To evaluate the subsidy, consider a two-person household planning to purchase a home in k years, that contributed \$2,000 (\$1,000 per household member) to the RHSP each year. The total value of the household's RHSP account k periods hence would be

$$(2) \quad V_{RHSP} = 2000 * [(1 + i)^k + (1 + i)^{k-1} + \dots + 1].$$

By comparison, if these funds had been invested in taxable instruments, their value in k periods would have been

$$(3) \quad V_{TAX} = 2000 * (1 - \theta) * [(1 + i(1 - \theta))^k + (1 + i(1 - \theta))^{k-1} + \dots + 1].$$

Table 9.1 illustrates the magnitude of V_{RHSP} and V_{TAX} for several values of the marginal tax rate, θ , and the number of years until planned house purchase. For constrained households, the subsidy is worth several thousand dollars, largely because RHSP contributions are made with before-tax dollars.

The entries in the third row of each panel in table 9.1 suggest that for taxpayers facing constraints on their tax-deferred saving contributions, the RHSP changes the effective user cost by several percentage points for first-time buyers, especially late in the subsidy program when buyers could have accumulated for as long as ten years.¹ For a household participating in the program and purchasing a median-priced house in 1980, the subsidy would have amounted to 7–9 percent of the house value.

1. The RHSP program, while created to encourage home ownership, could have caused some households to *defer* first-time buying, in order to take greater advantage of the RHSP subsidy. Engelhardt (1990) presents a more complete discussion of RHSPs and their effects.

Table 9.1 Incremental Buying Power of Canadian RHSP Accounts

	Number of Years until House Purchase			
	3	5	7	9
<i>i</i> = 10%				
V_{RHSP}^a	9.3	15.4	22.9	31.9
$\Delta = V_{RHSP} - V_{TAX}^a$	3.1	5.5	8.7	12.8
$\Delta/\text{Median House Price}$	4.8%	8.4%	13.4%	19.6%
<i>i</i> = 7%				
V_{RHSP}^a	8.9	14.3	20.5	27.6
$\Delta = V_{RHSP} - V_{TAX}^a$	2.9	4.9	7.3	10.3
$\Delta/\text{Median House Price}$	4.5%	7.5%	11.2%	15.8%

^aThousands of dollars.

Note: Calculations assume a nominal interest rate of 10% (upper panel) or 7% (lower panel), a marginal federal tax rate of 21% (corresponding to the 1981 rate for a couple with no children, earning the average taxable income, \$16,254), and a provincial tax rate of 44%, for a total marginal tax rate of 30.7%. The household is assumed to be constrained in making further contributions to other tax-deferred saving vehicles; otherwise the RHSP is worthless.

For a first-time buyer participating in the RHSP, for whom this program has value, the effective price of a house of size H (costing $P_o * H$) is $\mu = [P_o * H - (V_{RHSP} - V_{TAX})]/P_o * H$. Since households for whom RHSPs are valuable have also exhausted their tax-exempt investment options, they face an opportunity cost of $(1 - \theta)i$ on the equity invested in a home. For these households, the user cost is:

$$(4) \quad c_{o,Can} = [i\{(1 - \beta)(1 - \theta) + \beta\} + \tau_p + \delta + \alpha + m - \pi_e]P_o\mu,$$

where β is the loan-to-value ratio for the house. Note that the after-tax cost of mortgage borrowing is still i .

9.1.2 The User Cost of Home Ownership: United States

The key distinction between the U.S. and Canadian tax rules is that U.S. homeowners *who itemize their deductions* can deduct property taxes and mortgage interest from their taxable income. For an itemizing homeowner, the user cost is therefore

$$(5) \quad c_{o,US} = [(1 - \theta)(i + \tau_p) + \delta + \alpha + m - \pi_e]P_o.$$

The loan-to-value ratio is irrelevant, because the household can deduct interest payments, and would be taxable on interest or dividend receipts.

The average cost of home ownership can differ significantly from the marginal cost for some households who forego the standard deduction that they would receive if they did not itemize. For taxpayers who would not have itemized without the property tax and mortgage interest deduction, but do itemize because of these deductions, the tax saving from home ownership is $\theta * (\tau_p +$

Table 9.2 Itemization Status of U.S. Homeowners, 1985

	Millions
Number of Homeowners	56.2
Number of Homeowners with Mortgages	32.2 (57.3%)
Number of Tax Returns with Mortgage Deduction	28.1 (50.0%)
Number of Tax Returns with Real Estate Tax Deduction	32.1 (57.1%)

Sources: Homeowner information is from Bureau of the Census, *Housing in America, 1985-86*, Current Housing Report H-121, no. 19. Tax information is drawn from *1985 Statistics of Income: Individual Income Tax Returns*.

$i^*\beta)P_o^*H - S$, where H is the quantity of housing and S is the household's standard deduction. For homeowners who do not itemize even with their housing-related deductions, the marginal user cost is

$$(6) \quad c_{o.us'} = \{(1 - \beta)(1 - \theta) + \beta\}i + \tau_p + \delta + \alpha + m - \pi_e]P_o.$$

This expression is the same as the user cost for Canadian households with constraints on tax-exempt saving, but it does not include the RHSP term.

Table 9.2 presents evidence on the tax status of U.S. homeowners in 1985, prior to the Tax Reform Act, which reduced the probability that homeowners would choose to itemize. The number of tax returns with itemized property tax deductions was only 57% of the total number of owner-occupied properties. More than 40% of the homeownership population therefore faced the non-itemizer user cost for housing. In part, the surprisingly small share of homeowners who itemized reflects the fact that only 57.3% of homeowners in 1985 had mortgages. There is a very high rate of home ownership among elderly households, many of whom have paid off their mortgages.

9.1.3 User Cost Comparisons, 1980-1989

Table 9.3 reports user costs of home ownership for U.S. and Canadian households at several points in the income distribution, in 1980, 1985, and 1989. The calculations consider families with adjusted gross incomes of \$25,000, \$50,000, and \$250,000, and are based on actual interest rates and inflationary expectations (calculated as an average of actual inflation values for the five prior years). There are differences in the observed long-term interest rates in the two nations, and these are partly reflected in the user-cost calculations. The user costs assume the same values of depreciation and maintenance costs and the same risk premium for housing investment in Canada and the United States. Marginal tax rates in each case combine federal and state or provincial marginal tax rates.² The reported user costs are *percentages of price*; that is, they are the user costs in earlier equations divided by P_o .

2. The Canadian calculations assume that each household faces Ontario provincial taxes, as well as federal income tax. The U.S. calculations assume a 6% state income tax on the same base as the federal tax.

Table 9.3 Homeowner User Costs, United States and Canada, 1980–1989

	1980		1985		1989	
	Canada	U.S.	Canada	U.S.	Canada	U.S.
AGI = \$25,000 ^a	.147	.103	.133	.131	.167	.140
AGI = \$50,000	.147	.076	.133	.116	.167	.125
AGI = \$250,000 ^b	.147/.094	.039	.133/.098	.088	.167/.134	.119
<i>Background Parameters</i>						
Marginal Tax Rates						
AGI = \$25,000	30	23	28	21	26	20
AGI = \$50,000	47	41	37	32	40	32
AGI = \$250,000	62	6	50	53	44	37
Mortgage Rate	14.3	12.7	11.7	11.6	12.2	10.1
Expected Inflation	8.7	8.9	7.5	5.5	4.6	3.6

Note: AGIs are in 1989 U.S. dollars.

^aFor a U.S. homeowner in the AGI = \$25,000 category who does not itemize, the user costs are .119, .145, and .152 in 1980, 1985, and 1989 respectively. All other U.S. entries assume that the homeowner itemizes and therefore claims the mortgage interest and property tax deductions.

^bThe two entries for Canada correspond to a taxpayer who is not, and who is, taxed on marginal portfolio investments. The calculations assume no RHSP value to the household.

The calculations in table 9.3 reflect the various important changes in the U.S. and Canadian tax environment during the last decade.³ In the United States, the Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986 lowered personal income tax rates. With a constant pretax interest rate at which households borrow and lend, a lowered personal income tax rate *raises* the after-tax cost of home ownership. In 1980, the weighted-average marginal federal tax rate on mortgage interest deductions was 32%. By 1984, when the rate reductions of 1981 had taken full effect, this average tax rate was 28%. Although data on the post-1986 average are not yet available, it will surely be lower than that for previous years.

The 1986 reform also reduced the fraction of the nonhomeowning population that would itemize. For a joint filer, the standard deduction's rise from \$3,670 to \$5,000 exerted a negative effect on the incentive to own for households in lower and middle income brackets.

3. None of the reported calculations depend on the household's loan-to-value ratio. For some households, however, this can be a central parameter in the user cost, because there are different after-tax costs to borrowing and lending. Some high-income Canadian households face this situation. For the United States, the average loan-to-value ratio for owner-occupied real estate has varied between 36% (1978) and 50% (1989). Surveys by Chicago Title Insurance Company suggest an average down payment as a fraction of sales price of 24% in 1988, with smaller down payments (15%) by first-time buyers. Analogous data on loan-to-value ratios are not available for Canada. Data from the Canadian Bankers' Association indicate that 61% of all new mortgages by major Canadian chartered banks involve down payments of 25% or more. The debt-to-value ratio is higher (the median is more than 90%) for loans under the National Housing Act.

The largest effects of the 1986 reform were at high tax rates. For a household with income of \$250,000 and the average deductions for this group, the tax reform lowered the federal marginal tax rate from 50% to 33%, raising the user cost (at 1985 interest rates) by 2.3 percentage points when the nominal mortgage rate is 11.7% and the property tax rate is 2%. The reform would have had to reduce interest rates by nearly three hundred basis points to offset this change in the value of the tax deduction. The effect of rate reductions on home ownership incentives for those in lower income brackets is much smaller, since the decline in tax rates in the 1986 reform was less pronounced. For the household with AGI of \$25,000 in 1989, the tax reform lowered the federal marginal tax rate from 16% to 15% and raised the user cost (in the benchmark case) slightly. Some middle-income households actually experienced increases in marginal tax rates as a result of the 1986 reform (see Hausman and Poterba 1987). For those households, the user cost may even have declined.

Table 9.3 shows that the changes in marginal tax rates in Canada during the last decade are less pronounced than those in the United States. A household with an adjusted gross income of \$50,000, for example, experienced a marginal tax rate decline from 47% to 40% during the 1980s. The substantial rise in real interest rates during the decade, however, is the principal factor influencing user costs in Canada.⁴ Real interest rate movements alter the user cost by more in Canada than in the United States, because there is no tax wedge to blunt their effects. For most households, user costs at the end of the decade are estimated to be between two and three hundred basis points above their level at the beginning of the decade.

One implication of the calculations in table 9.3 is that there is less cross-sectional variation in housing user costs in Canada than in the United States. This is because marginal tax rates play a role in determining the user cost in the United States. In addition, most of the Canadian entries in table 9.3 do not reflect the sort of variation that results from itemization status in the United States. In 1980, for example, an itemizing homeowner faced a marginal user cost of .103, while a first-time buyer with AGI of \$25,000 who did not itemize faced a marginal user cost of .119. This is more than three times the level of the user cost facing high-tax-rate itemizing households.

An important limitation of the calculations in table 9.3 is their partial-equilibrium nature. The 1981 and 1986 tax reforms in the United States changed the tax treatment of housing, as well as of many other assets. In particular, the 1986 reform raised the tax burden on corporate assets while bringing tax burdens on equipment, structures, and other assets into closer alignment. If tax rates on housing and all other assets rise and capital is incompletely mobile internationally, so that changes in the U.S. system affect after-tax returns to U.S. investors, then a tax change of this type should reduce

4. For some households, the changes in marginal rates could have influenced user costs, but this is not the benchmark case we consider.

real after-tax interest rates. The amount of such a decline is crucial for calibrating the actual changes in housing user costs. In the case of the United States and Canada, differences in the tax treatment of *nonhousing* assets (e.g., the more generous treatment of capital gains in Canada) may be a central factor in determining the tax system's net subsidy to housing. For the benchmark households my analysis focuses on, virtually all of the effects of the Canadian tax code must enter through the required return on housing assets.

General-equilibrium simulations of the type performed by Hendershott (1987) or Berkovec and Fullerton (1989) are needed to aggregate the different tax changes on various assets into the single summary measure—the change in the interest rate—through which other aspects of tax reform affect the housing market. Such models can provide insight into the importance of differences in the taxation of nonhousing assets to the net tax subsidy to housing. They are also the only practical way to handle changes in the indirect tax burdens on nonhousing goods, such as the Canadian Goods and Services Tax, which took effect in early 1991.

9.1.4 Rental User Costs and Tenure Choice

For a homeowner with a particular pattern of income and deductions and facing a given tax rate, it is straightforward to compute the user cost of owning a home. A similar statement applies to the user cost of a rental property. In the rental context, the disparities across potential landlords are more controversial, however, because the law of one price implies that the rental housing market must clear at some real rent, and it is not clear which landlord is the marginal supplier of rental property. This conceptual difficulty confounds studies of how tax reforms affect the tenure-choice incentives of different households, as well as tests of how such reforms affect real rent levels. Gravelle (1987) and Poterba (1990) discuss these issues in more detail.

A complete model of taxation and housing markets, incorporating the tax treatment of rental housing and with endogenous tenure choice, is beyond the current modeling exercise. The central role of the tax treatment of rental housing has been noted by Clayton (1974) for Canada and by Titman (1982) for the United States. Fallis and Smith (1989) discuss the effects of the recent Canadian changes with respect to rental markets and owner-occupants; Poterba (1990) provides a similar treatment for the United States.

9.2 Housing in Perspective: U.S.-Canadian Comparisons

In standard models of housing demand, the differences in the tax treatment of owner-occupied housing in the United States and Canada should lead to different patterns of housing wealth, home ownership, and housing investment. This section presents simple summary statistics on each of these issues.

Table 9.4 shows the share of owner-occupied capital in the net national capital stock, and as a fraction of gross domestic product, for both the United

Table 9.4 Residential Capital Intensity, Canada and the United States, 1960–1989

Year	Canada	U.S.
Owner-Occupied Capital/Total Capital ^a		
1961	.178	.264
1970	.204	.245
1980	.228	.263
1989	.271	.270
Owner-Occupied Capital/GDP		
1961	.550	.598
1970	.573	.547
1980	.686	.708
1989	.733	.632
Owner-Occupied Capital/Residential Capital		
1961	.820	.719
1970	.808	.715
1980	.827	.710
1989	.830	.723

Sources: Board of Governors of the Federal Reserve System, *Balance Sheets for the U.S. Economy, 1945–89*; Statistics Canada, Flow of Funds Division, *Canadian National Balance Sheets, 1961–84, 1964–89*.

^aThe total capital stock is the sum of plants and equipment, residential capital, consumer durables, and inventories.

States and Canada. The data suggest that the United States has traditionally been a more residential-capital-intensive nation than Canada. In the early 1960s, more than one-quarter of the U.S. capital stock was owner-occupied housing, while the analogous fraction for Canada was less than one-fifth. There has been little change, however, in the residential share of the U.S. capital stock during the last three decades, while the Canadian residential capital stock has expanded significantly relative to other components of capital. At the end of 1989, the Canadian share was 27.1%, essentially the same as the U.S. value.

The center panel of table 9.4 shows owner-occupied residential capital as a share of current GDP. Again, the data suggest a higher ratio for the United States than for Canada in the 1960s, but with relatively rapid convergence. The Canadian owner-occupied capital/GDP ratio was .733 in 1989, above the U.S. value of .632. For the United States, this ratio declined from over 70% at the beginning of the 1980s, as real house prices fell.

The bottom panel of table 9.4 shows the share of total residential capital accounted for by owner-occupied housing. In the United States, this fraction is slightly greater than 70%, while in Canada, it exceeds 80%. While these figures are not necessarily inconsistent with the differential tax treatment of owners in the two nations, since rental housing also receives somewhat different treatment, it is not *prima facie* support for the view that the more generous tax treatment of homeowners in the U.S. has expanded the stock of owner-occupied housing.

To evaluate the influence of tax policy on home ownership, table 9.5 reports the rates of home ownership, both in aggregate and for particular age groups, in the United States and Canada during the last two decades. The standard claim that the U.S. tax code encourages home ownership receives some support in these data, since the U.S. home ownership rate exceeds that of Canada in each year. At young ages, however, the pattern reverses in the 1980s. At the beginning of the 1970s, the home ownership rate for persons under age 35 was 6 percentage points higher in the United States than in Canada. The combination of high house prices and interest rates in the United States, and the RHSP program in Canada, reversed this pattern by 1980. In that year, the home ownership rate for persons under age 35 was 9 percentage points higher in Canada than in the United States. The difference has narrowed since then, but the home ownership rate for young households is still higher in Canada than in the United States. For older households, the higher home ownership rate persists in the United States throughout the time period.

These data are somewhat difficult to reconcile with more standard analyses of the housing subsidy. If the U.S. tax system encourages home ownership as much (relatively) as the user costs suggest, then one would expect higher home ownership rates in the United States than in Canada. The failure of the data to confirm this prediction suggests an important need for further modeling of the housing markets in both countries.

Figures 9.1 through 9.3 present data on the time-series pattern of three macroeconomic features of the housing market in each nation. Figure 9.1 shows

Table 9.5 Age-Specific Home Ownership Rates, Canada and the United States, 1973–1988

Age Group	1970		1980		1986	
	Canada	U.S.	Canada	U.S.	Canada	U.S. ^a
<35	35.9%	41.6%	56.3%	47.5%	42.0%	39.2%
35–64	70.6	71.8	73.7	78.4	72.7	73.5
>65	67.7	68.1	63.0	74.1	64.0	75.1
Total	60.3	63.3	62.1	68.0	62.1	64.0

Sources: U.S.: 1970 Census, 1980 and 1987 Annual Housing Survey. Canada: Unpublished data provided by Statistics Canada.

^a1986 U.S. entries correspond to March 1987.

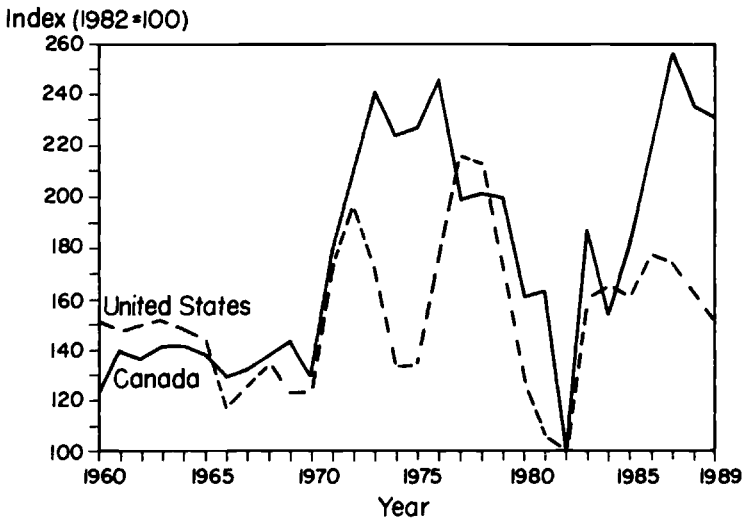


Fig. 9.1 Indices of single-unit housing starts, 1960-89

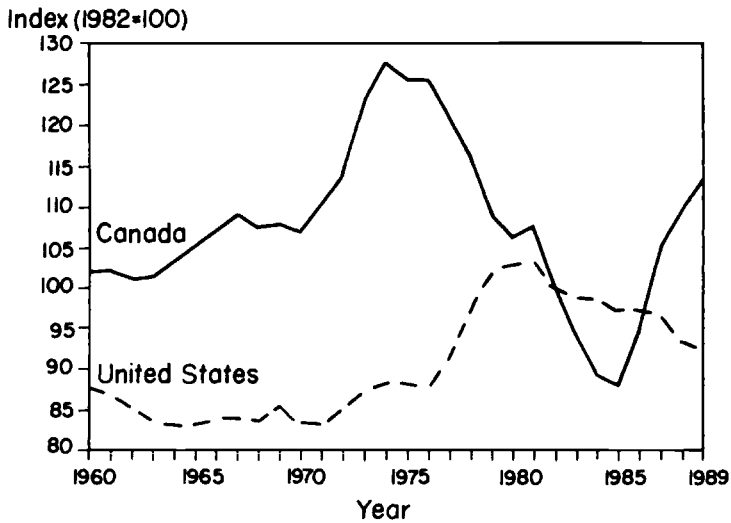


Fig. 9.2 Indices of real house prices, 1960-89

the time path of single-family housing starts in the United States and Canada. The relatively weak performance of the U.S. market during the late 1980s is not matched by a slump in Canadian building.

Figure 9.2 plots data on real single-family house prices and suggests that tax factors may have affected house prices in the United States. Canadian house prices did not increase during the late 1970s. While U.S. prices rose by

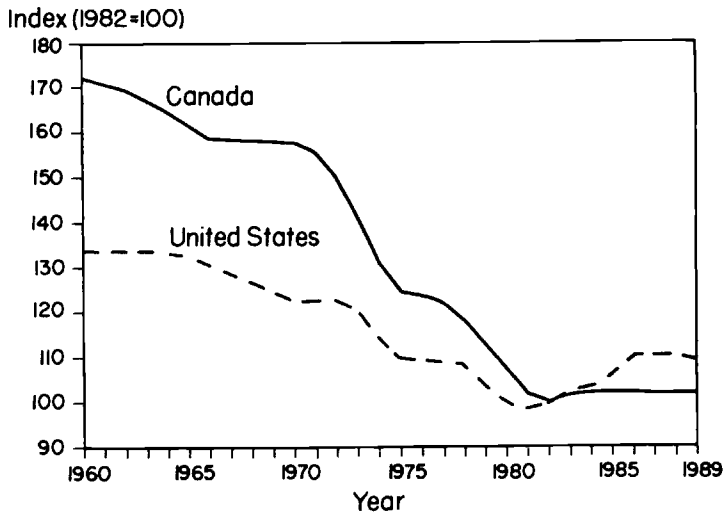


Fig. 9.3 Indices of real rents, 1960–89

18% during 1975–80, Canadian house prices fell by 14%. The 35% decline in real Canadian house prices during 1975–85, a period when the “baby boom” generation was entering its home-buying years, raises doubts about purely demographic explanations for house price changes, such as that proposed by Mankiw and Weil (1989).

Finally, figure 9.3 shows the time pattern of real rents. The rent data raise puzzles for standard tax analyses of the housing market. In the United States, real rents increased by nearly 10% during the early 1980s, at a time when tax subsidies were particularly generous toward rental properties. In Canada, the real rent series displays an even stranger pattern, with a real decline of more than 50% during 1970–89. Rent control, which was introduced in Canada in the mid-1970s, was probably an important factor in this decline.

9.3 Tax Policy and Housing Markets: An Asset-Price Framework

The asset-price approach to incidence, which recognizes the short-run fixity of various categories of capital goods, provides a natural framework for analyzing how taxation affects the owner-occupied housing market. This approach, applied by Summers (1981) and Poterba (1984) among others, recognizes that both the market for housing services and the market for the flow of new construction must simultaneously clear.

If $H(t)$ denotes the total stock of housing at time t , and the service flow of housing services is proportional to the stock of existing units, then there is a market-clearing rental rate $R(H(t))$, $R' < 0$, at which all rental units will be

held. In equilibrium, this rental rate must equal the user cost of owner-occupied housing services:

$$(7) \quad R(H(t)) = c_o(t).$$

For given values of the interest rate, tax parameters, depreciation, and maintenance, this equation can be satisfied either through variation in the real price of houses or through movements in expected rates of price appreciation. In the Canadian context, for example, this equation can be solved to find the expected real appreciation rate as a function of the current housing stock and current house price:

$$(8) \quad E[P_o(t+1) - P_o(t)] = [(1 - \theta)i + \delta + m + \alpha + \tau_p - \pi_e]P_o(t) - R(H(t)).$$

One implication of this equation is that, assuming households have rational expectations, the value of real house prices at t can be written as a discounted integral of future housing service flows, net of depreciation and maintenance costs. The discount rate is the after-tax borrowing rate plus the risk premium, α :

$$(9) \quad P_o(t) = \int_0^{\infty} R(H(t+s)) e^{-((1-\theta)i + \alpha + \delta + \tau_p + m - \pi)s} ds.$$

The flow of new construction is determined by the relative price of houses; builders compare this price with the cost of new construction and choose the level of building to undertake. This can be represented as an investment supply curve,

$$(10) \quad I(t) = \dot{H}(t) + \delta H(t) = \xi(P_o(t)),$$

where $H(t)$ denotes net investment in owner-occupied housing. A steady state obtains when net investment is zero.⁵

This framework can be used, as in Poterba (1984), to study how various tax reforms should affect house prices and the level of housing investment. For example, consider a decline in the marginal tax rate for the housing consumer. In this case housing demand falls, and the steady-state housing stock contracts. There is a short-run decline in house prices followed by a period of gradual return to the steady state. Given the model's saddle-point stability property, there is a *unique* house price at the time of the shock that will lead to the new steady state. The adjustment dynamics following such a policy shock are shown in Figure 9.4. Finding this price decrease is the objective of section 9.5. Before considering such experiments, however, the next section

5. In a growing economy, with population growth at rate n and productivity at rate g , the real housing capital stock will experience steady-state growth at rate $n + \Delta g$, where Δ is the income elasticity of housing demand.

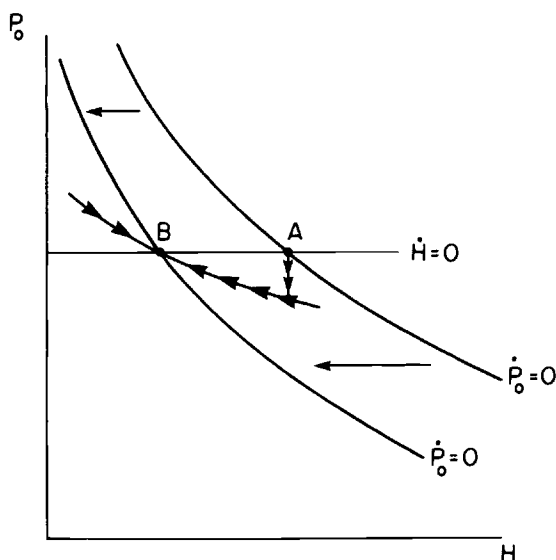


Fig. 9.4 Housing market dynamics

reports estimates of the investment-supply functions for the United States and Canada.

9.4 Calibrating the Housing Investment Function

To evaluate the housing market effects of various policies using the foregoing asset-price framework, it is necessary to calibrate the stock-demand equation for housing services, as well as the flow-supply equation for new construction. There are many estimates, based on household-level data, of housing demand; most use U.S. data, but there is some confirmatory evidence for Canada as well. Previous research provides less guidance on the investment-supply equation. After summarizing prior work on housing demand, this section reports new estimates of housing supply equations for Canada and the United States.

9.4.1 Housing Demand Elasticities

The voluminous literature on the demand for owner-occupied housing, based largely on household data for the United States and summarized in Rosen (1985) and Olsen (1987), suggests price elasticities with respect to the user cost of approximately -1.0 . Similar estimates do not appear to be available for Canada; therefore, a value of -1.0 has been assumed for Canada as well.

In calibrating the asset-price model, I assume a price elasticity of -1.0 and specify a constant-elasticity housing demand function:

$$(11) \quad H(t) = c_o(t)^\gamma.$$

9.4.2 The Flow Supply of New Construction

The second component of the housing market model sketched above is a flow supply of new construction. This relates the level of new construction activity to the relative price of single-family houses. The relative house price is the summary statistic for all of the demand-side factors that affect the housing market.

To facilitate comparisons of the United States and Canada, a very simple investment-supply equation is used for both nations:

$$(12) \quad (I_t/GNP_t) = \beta_o + \beta_1*(P_{o,t}/P_{gnp,t}) + \varepsilon_t.$$

I_t is the level of new single-family housing investment in each nation, and the dependent variable is this investment as a share of GNP, to reflect the allocation of resources between house building and other activities. The independent variable is the price of owner-occupied houses, in each case excluding the value of land, relative to the GNP deflator. The latter is a proxy for the costs of construction. Because builders may be choosing between constructing new houses and other types of building, in some cases this specification is augmented with a variable for the real price of nonresidential structures. This specification ignores many factors (e.g., the presence of credit constraints) that have typically been included in models of single-family housing investment. It reflects the strict interpretation of the asset-price model. Earlier work (Poterba 1984) included additional variables for the United States, and there should be future work to apply the same approach to Canadian data.

Data on house prices are available beginning with 1969 for both Canada and the United States. Prior to 1976, the Canadian index is based on a simple average of new-house prices (excluding land) in six cities. After 1976, the data series is more comprehensive. In the United States, the data series on house prices is the result of a hedonic procedure for correcting quality change; the series reports the price of a constant-quality house, of the type constructed in 1982, in each quarter since 1969. For the price of nonresidential structures, we used the GNP deflator for these structures.

The results of estimating these equations are reported in Table 9.6.⁶ The first column for each nation presents ordinary least squares estimates of equation (12). For both nations, there is a positive relationship between the level of real house prices and the construction of single-family houses. The link appears statistically and substantively more significant in Canada than in the United States. The last two columns for each nation report alternative specifications of the investment function. Inclusion of the alternative price variable,

6. Treating the national housing market as one, in which builders choose to supply new structures based on a single price, neglects the very important regional variation in housing markets. In principle, an investment-supply equation like the one I estimate for the nation could also be estimated for specific regions.

Table 9.6 Housing Investment Supply Equations, United States and Canada

Estimation Method	United States			Canada		
	OLS	OLS	IV	OLS	OLS	IV
Constant	1.73 (1.20)	6.40 (1.92)	7.13 (2.06)	-1.06 (0.90)	5.92 (1.92)	6.06 (2.52)
Real house price	0.53 (1.22)	2.00 (1.26)	1.13 (2.52)	2.38 (0.78)	3.54 (0.65)	3.15 (0.82)
Real price of nonresidential structures		-6.42 (2.13)	-6.28 (2.58)		-8.44 (2.21)	-8.16 (2.40)
Autoregressive parameter	.95 (.04)	.95 (.04)	.94 (.05)	.84 (.06)	.75 (.08)	.77 (.09)
R ²	.90	.91	.91	.88	.90	.90

Note: Equations for both countries are estimated for the 1969:1–1989:4 sample period. Standard errors are shown in parentheses. See text for further data description. The instrumental variables estimates (column 3) treat the contemporaneous real house price as endogenous and use lagged values of the house price as instruments.

the nonresidential structures deflator, strengthens the positive effect of real house prices in both nations. The last column in each set of estimates recognizes the potential endogeneity of real house prices in the investment model. Since shocks to the investment function affect the growth of the housing stock, they affect the future trajectory of real rents and hence current house prices. Positive innovations in the supply function reduce real house prices, and vice versa. To address this possibility, the last column in each case uses lagged values of the real house price as instruments for the actual house price, following Fair's (1970) procedure. This does not significantly affect the estimated coefficients for either country.

The results are broadly supportive of a positive link between investment and real house prices. In the United States, a 10% increase in real house prices would raise housing investment by between .1% and .2% of GNP, or approximately seven billion 1989 dollars. For Canada, the elasticity is even larger; a similar-sized relative house price move would lead to an increase of .3% of GNP in single-family housing investment, or nearly a two-billion-dollar increase (in 1989 Canadian dollars).

The investment supply equations reported here are not fully articulated investment equations for either nation. Nevertheless, they provide a foundation for calibrating the asset-price model of the last section and for estimating how changes in tax policy might affect house prices.

9.5 Policy Experiments in the Asset-Price Framework

The estimated investment-supply equations can be linked with demand elasticities from the literature to assess how various tax and macroeconomic

changes during the last decade would affect the housing market in the simple asset-price framework. To impose the condition that the steady-state house price is constant in the simulations, the investment equations are respecified in the form

$$(13) \quad I/H = \beta_0 + \beta_1 * P_o,$$

by multiplying through by the average value of GNP/H , approximately 1.6 in both the United States and Canada. In steady state, a real house price of 1 must call forth the level of replacement investment plus the level needed to accommodate economic growth. Housing demand growth of 2% per year is assumed, implying that $I/H = .014 + .02 = .034$ (where .014 is the depreciation rate) in steady state. This requirement, along with the modified value of β_1 from the foregoing equations, is used to find the respecified investment functions:

$$(14a) \quad (I/H)_{Can} = - .014 + .048 * P_o (I/H)_{US}$$

$$(14b) \quad = .010 + .024 * P_o.$$

The investment equations suggest that housing investment responds more quickly to a given price change in Canada than in the United States. Smaller price increases are thus implied in response to favorable policy shocks in Canada.

Table 9.7 reports simulation results for housing market responses to three sets of policy shocks: a shift in the United States from 1980 or 1985 tax rates to 1989 values, holding constant all macroeconomic factors; a shift in the United States from 1980 or 1985 inflation rates to 1989 values, holding the real interest rate and tax parameters constant; and an increase in the Canadian retail sales tax by 5 percentage points on all nonhousing goods. The results focus on the user-cost effects for a homeowner with an AGI of \$50,000; different calculations would obtain for the other example households considered above.

Although each of the first two reforms has a substantial effect on the U.S. housing market, neither affects the Canadian market because neither marginal tax rates nor the inflation rate enter the benchmark user cost calculation. The first panel of table 9.7 shows the effects of the tax rate changes in the United States. The long-run reduction in housing demand from falling marginal tax rates is calculated at 17.1% since 1980. This figure reflects the large change in marginal rates in the United States and the important interaction between marginal rates and housing user costs because interest payments are tax-deductible.

The second panel of table 9.7 considers the effects of inflation shocks. The U.S. user cost of home ownership is sensitive to the inflation rate, while the Canadian user cost is not, at least for households that are not taxed on marginal portfolio investments. Assuming that expected inflation in the United

Table 9.7 Housing Market Reactions to Tax and Economic Changes

	1980	1985
<i>Shift to 1989 Tax Rates (U.S.)</i>		
Base Case Tax Rate	41	32
Hypothetical Tax Rate	32	32
Base Case User Cost	.076	.116
Hypothetical User Cost	.089	.116
Long-run Housing Demand	-.171	0
Short-run House Price Change	-.128	0
<i>Shift to 1989 Inflation Rate (U.S.)</i>		
Base Case Inflation Rate	.089	.055
Hypothetical Inflation Rate	.036	.036
Base Case User Cost	.076	.116
Hypothetical User Cost	.099	.122
Long-run Housing Demand	-.303	-.050
Short-run House Price Change	-.237	-.038
<i>Shift to Higher Retail Sales Tax (Canada)</i>		
Base Case User Cost	.147	.133
Hypothetical User Cost	.140	.126
Long-run Housing Demand	+.050	+.050
Short-run House Price Change	+.032	+.032

Note: Estimates are based on change in user costs for households with 1989 AGI of \$50,000; the underlying user costs are reported in table 9.3. The simulation algorithm employs the investment-supply models in equation (14) and finds the perfect-foresight price change associated with each policy.

States declined by more than 5% between 1980 and 1989, and holding other factors fixed, the asset-price model suggests that the demand for owner-occupied housing by the stylized person in table 9.7 should have been reduced by nearly 30 percent.

The final policy experiment, shown in the bottom panel of table 9.7, is confined to Canada. This is an increase of 5 percentage points in the retail sales tax on all goods except housing services. Assume that the revenue effects of the tax are offset with lump-sum transfers. This policy raises the demand for housing by 5% in the long run, and in the short run it increases the demand for housing by 3.2%. By comparison, a similar-sized shock to long-run housing demand would raise U.S. house prices by 3.8%, because of the lower elasticity of housing supply.

9.6 Conclusions

This paper has only begun to exploit the rich research opportunities for tax economists presented by the U.S. and Canadian housing markets. Although the nations are similar in many ways, the tax treatment of both housing and nonhousing assets varies substantially, and the timing of tax changes toward rental and owner-occupied housing differs between nations. A set of natural

experiments is thus provided for assessing whether housing demand is sensitive to tax parameters, how user costs affect tenure choice, and how macroeconomic factors operate through disparate tax codes to affect the housing market.

Future research could focus on how the RHSP program has affected the housing market in Canada, how the differential tax subsidies to rental properties have affected rents, and how the divergent patterns of real price and real rent movements in the two countries are related to tax considerations. The findings should provide substantial input for calibrating more complete general-equilibrium models that endogenize tenure choice, as well as the quantity of housing consumed (see Goulder and Summers 1989).

Another research priority should be the modeling of housing markets at a more disaggregate level. My analysis focuses on the aggregate level of housing investment, neglecting the important variation across metropolitan housing markets. One possible topic for case-study analysis is: How does the housing market in a pair of similar U.S. and Canadian cities compare? Regional variation in income growth, tax rates, and other factors should also prove useful in studying more general questions of housing market dynamics.

References

- Berkovec, James, and Don Fullerton. 1989. The General Equilibrium Effects of Inflation on Housing Consumption and Investment. *American Economic Review* 79: 277–82.
- Clayton, Frank A. 1974. Income Taxes and Subsidies to Owners and Renters: A Comparison of U.S. and Canadian Experience. *Canadian Tax Journal* 22 (May/June): 295–305.
- Engelhardt, Gary. 1990. House Prices and the Saving Behavior of Young Renters: Evidence from the RHOSP Program. MIT. Manuscript.
- Fair, Ray C. 1970. The Estimation of Simultaneous Equation Models with Lagged Endogenous Variables and First Order Serially Correlated Errors. *Econometrica* 38:507–46.
- Fallis, George, and Lawrence Smith. 1989. Tax Reform and Residential Real Estate. In *The Economic Impacts of Tax Reform*, ed. Jack Mintz and John Whalley. Toronto: Canadian Tax Foundation.
- Goulder, Lawrence H., and Lawrence H. Summers. 1989. Tax Policy, Asset Prices, and Growth: A General Equilibrium Analysis. *Journal of Public Economics* 38:265–96.
- Gravelle, Jane G. 1987. U.S. Tax Policy and Rental Housing: An Economic Analysis. Congressional Research Service Report no. 85–208E. Washington, D.C.
- Hausman, Jerry A., and James M. Poterba. 1987. Household Behavior and the Tax Reform Act of 1986. *Journal of Economic Perspectives* 1: 101–19.
- Hendershott, Patric H. 1987. Tax Changes and Capital Allocation in the 1980s. In *The Effects of Taxation on Capital Formation*, ed. M. Feldstein. Chicago: University of Chicago Press.
- Mankiw, N. Gregory, and David Weil. 1989. The Baby Boom, the Baby Bust, and the Housing Market. *Regional Science and Urban Economics* 19:235–58.

- Olsen, Edgar O. 1987. The Demand and Supply of Housing Service: A Critical Survey of the Empirical Literature. In *Handbook of Regional and Urban Economics* ed. Edwin S. Mills, vol. 2. Amsterdam: North Holland.
- Poterba, James M. 1984. Tax Subsidies to Owner Occupied Housing: An Asset Price Approach. *Quarterly Journal of Economics* 99: 729–52.
- . 1990. Taxation and Housing Markets: Preliminary Evidence on the Effects of the Tax Reform Act of 1986. In *The Effects of the Tax Reform Act of 1986*, ed. Joel Slemrod. Cambridge: MIT Press.
- Rosen, Harvey S. 1985. Housing Subsidies: Effects on Housing Decisions, Efficiency, and Equity. In *Handbook of Public Economics*, ed. M. Feldstein and A. Auerbach, vol. 1, 375–420. Amsterdam: North Holland.
- Summers, Lawrence. 1981. Taxes and Corporate Investment: A Q-Theory Approach. *Brookings Papers on Economic Activity* 1:67–127. Washington, D.C.
- Titman, Sheridan. 1982. The Effects of Anticipated Inflation on Housing Market Equilibrium. *Journal of Finance* 37:827–42.