ASSET PRICE APPROACH TO INCIDENCE

14.471 - Fall 2012

Many taxes are levied on durable assets (houses, physical capital such as buildings and equipment, patents, natural resource stocks)

These are traded assets with prices - changes in current and future taxes can affect these prices.

Key component of incidence: price changes for existing asset owners. How much do prices change? By the change in the present discounted value of future tax payments associated with that asset.

Best illustrations are in markets with long-lived assets: corporate capital, land, housing are examples. Focus on owner-occupied homes following Poterba QJE 1984.

Equilibrium condition in durable asset market:

Value of asset services per unit: R(H)

R'(H) < 0 reflects diminishing value of housing capital

R(H) must equal the investor cost of holding the asset for one period. This cost includes the depreciation of the asset (exponential at rate δ per period) and the opportunity cost of funds. We denote this as $(1-\tau)r$: the after-tax interest rate. There might also be a risk premium, but assume not for now.

The investor cost also includes any capital gain or loss to holding the asset. A capital gain <u>reduces</u> the investor cost of holding the asset; a capital loss increases it.

$q_{H,t}$ = asset price at the start of period t

$q_{H,t+1} - q_{H,t}$ = capital gain or loss during period t

Equilibrium Condition:

(1) $R(H_t) = q_{H,t}(r(1-\tau) + \delta) - (q_{H,t+1} - q_{H,t})$.

Consider a tax on each house that takes the form of a required payment T_t in period t. Because houses are long-lived assets, even taxes that will not be levied until future years can depress prices today. In each period when the tax is levied, the equilibrium condition becomes

(2) $R(H_t) - T_t = q_{H,t}(1 + r(1-\tau) + \delta) - q_{H,t+1}$.

Note that $q_{H,t+1}$ is not generally know at time period t. Assume perfect foresight; one could also embed this analysis in a stochastic model of price determination.

To find the q_H from (2), solve <u>forward</u> by rewriting (2) as:

(3) $$q_{H,t} = \frac{R(H_t) - T_t + q_{H,t+1}}{1 + r(1-\tau) + \delta}.$$

Solving recursively by substituting for $q_{H,t+1}$ yields, after multiple substitutions,

$$(4) \qquad q_{H,t} = \sum_{i=0}^{S} \frac{R(H_{t+i}) - T_{t+i}}{\left(1 + r(1-\tau) + \delta\right)^{i+1}} + \frac{q_{H,t+S}}{\left(1 + r(1-\tau) + \delta\right)^{S+1}}.$$

We impose a transversality condition to rule out an "exploding" asset price:

$$(5) \qquad \lim_{S \to \infty} \frac{q_{H,t+S}}{\left(1 + r(1-\tau) + \delta\right)^{S+1}} = 0.$$

With this condition we can see how a stream of tax liabilities $\{T_t\}$ will affect the price of houses:

$$(6) \qquad q_{H,t} = \sum_{i=0}^{\infty} \frac{R(H_{t+i})}{\left(1 + r(1-\tau) + \delta\right)^{i+1}} - \sum_{i=0}^{\infty} \frac{T_{t+i}}{\left(1 + r(1-\tau) + \delta\right)^{i+1}}.$$

The second term is the present discounted value of current and future tax payments.

If the stock of housing is fixed, so $H_{t+i} = H_t$ for all i, then from (6) we can determine $dq_{H,t}/dT_{t+i}$. When the housing stock is endogenous, however, changes in future tax policies will also affect current and future investment, hence $\{H_t\}$. In general the effect of changing $\{H_t\}$ will offset the effect of taxes on house prices. When taxes rise, thereby depressing prices, housing construction will

decline. That will raise the rental value of a unit of housing services, thereby helping to raise prices.

Need to model supply function for new construction:

(7) $\qquad I_t = \psi(q_{H,t})$

where I_t denotes gross construction of new housing. The <u>net</u> change in the housing stock is given by

(8) $\qquad H_{t+1} - H_t = \psi(q_{H,t}) - \delta H_t.$

The corresponding equation for the evolution of house prices from (2) is

(9) $\qquad q_{H,t+1} - q_{H,t} = (r(1-\tau) + \delta) q_{H,t} - R(H_t) + T_t.$

Equations (8) and (9) define a two-equation system of difference equations in two variables: (q_H, H). To analyze how the value of $q_{H,t}$ responds to a shock to $\{T_t\}$, we analyze the stability properties of this system of difference equations using phase diagram methods.

The figure below shows the loci on which q_H and H are respectively constant. The steady state is defined by:

(10) $\quad \psi(q_H) = \delta H$ and $(r(1-\tau) + \delta) q_H = R(H) - T.$

When the system is out of equilibrium, for example when a tax shock moves the (dq_H/dt) curve, there is a unique stable path that leads to the equilibrium point; conditional on a value of H, there is only one value of q_H that will result in the system evolving back to the equilibrium.
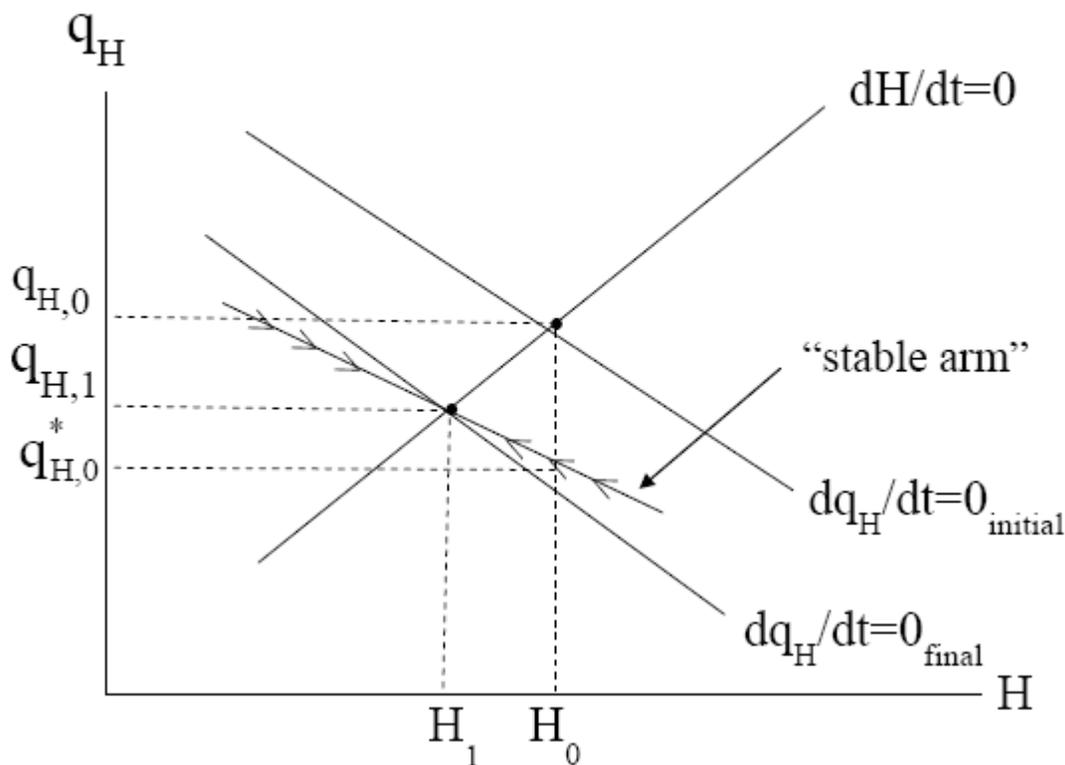
One can link this diagram to the basic partial equilibrium incidence diagram we have used before. Note that even when the $dH/dt = 0$ locus is horizontal, so there is a fixed long-run supply price of housing, a leftward shift in the $dq_H/dt = 0$ locus induced for example by a new tax on housing would create a transitory decline in house prices that would burden existing house owners.

To illustrate how this framework can be used to evaluate changes to housing tax policy, consider a plausible measure of the user cost of owner-occupied housing in the current tax law:

$$(11) \quad c = [1-\tau_y]*(\lambda r_M + (1-\lambda)r_{Alt} + \beta) + m + (1-\tau_{ded})*\tau_{prop} - \pi_e$$

where τ_y is the marginal income tax rate for mortgage interest and property tax deductions as well as investment income, r_M is the mortgage interest rate, λ is the loan-to-value ratio on the house (fraction of house financed with mortgage), r_{Alt} is the return on the alternative assets that the household might invest in if not using equity for a house, β denotes the pre-tax housing risk premium, m is the combined cost of depreciation and maintenance, τ_{prop} is the property tax rate, and π_e is the expected rate of nominal house price appreciation. Plausible parameter values for 2012 might be: $\tau_y = .25$, $r_M = r_{Alt} = .04$, $\lambda = 0.75$, $\beta = m = .02$, $\tau_{prop} = .015$, $\pi_e = .02$. This implies c = 0.05625.

What if we eliminate the federal income tax deduction for the property tax? Now c' = 0.06. This is an increase of 6.7 percent; with <u>fixed H</u> and a price elasticity of demand of -1, house prices would drop by 6.7 percent. Calibrated rational expectations model suggests -3.7 percent.

Empirical work to be done in asset price models:

(i) estimate elasticity of demand for the durable asset (this is calibrating R(H));
(ii) estimate supply curve $\psi(q_H)$
(iii) estimate how other endogenous variables (loan-to-value ratio, level of property taxes) might respond to changes in federal tax rules.

Estimates of User Costs of Owner-Occupied Housing in 2003 (from Poterba & Sinai, Natl Tax Jnl 2011; average = 0.059)

Age of Head	<40K	40-75K	75-125K	125-	250+
25-34	0.065	0.060	0.053	0.048	0.045
35-49	0.065	0.059	0.054	0.049	0.046
50-64	0.066	0.059	0.055	0.050	0.046
65+	0.070	0.059	0.056	0.053	0.049
All	0.068	0.059	0.054	0.050	0.046

Applications of Asset Price Incidence Analysis:

Proposition 13 in California: Property Tax Reform
(K. Rosen, JPE 1982)

Community	Property Tax Rate FY1978	Property Tax Rate FY1979
Berkeley	13.75	5.04
Pleasanton	12.83	5.60
Novato	10.62	4.81
Menlo Park	8.64	4.09
Atherton	8.81	4.14

ΔHouse Price = 7.28*Tax Saving + Home Attributes β
                        (2.45)

Impact of Corporate Tax Reform
(D. Cutler AER 1988)

Tax Reform Act of 1986 (TRA86) Generates Differential Benefits for Different Firms

Event Study Methodology: Return on Security i at time t:

$R_{it} = \alpha_i + \beta_i * R_{M,t} + \varepsilon_{it}$ (CAPM - could do multi-factor)

ADD: Variable capturing news of policy change. Let I_t denote indicator variable for days on which the

probability of tax reform rises. Let %Equip denote share of firm's capital stock that is equipment. Prediction: firms with more equipment (ITC was eliminated) should experience higher returns b/c their competition will have to pay more for equipment.

Estimate:

$$R_{it} = \alpha_i + \beta_i * R_{M,t} + \lambda \ EQUIP\%_i * I_t + \varepsilon_{it}$$

λ measures change in value -- but calibration requires an estimate of change in PROBABILITY of law passage over all I_t.

	λ without industry effects	λ with industry effects
One Day Window	0.018 (0.012)	0.000 (.015)
10-Day Window	0.083 (0.025)	0.035 (0.031)
30-Day Window	0.064 (0.043)	0.024 (0.051)

Predicted effect from simulation models: 0.07. Why are coefficients so much smaller?

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