Texas Structural Impact Model (TX-SIM)

Jorge Barro

Baker Institute of Public Policy

October 18, 2017

Model Overview

- ▶ Structural dynamic macroeconomic model

- ▶ Calibrated to the State of Texas economy

- ▶ Texas personal tax structure implemented

- ▶ Focus on key economic variables: consumption, income, labor, housing

Model Overview

- Open economy with heterogeneous households

- Elastic housing supply

- Household economic activity simulated over life-cycle

- Simulated data compared to survey data for model validation

Goals

- ▶ Evaluate Texas fiscal policy alternatives

- ▶ Allow for budget neutrality

- ▶ Determine effects of fiscal reform on tax progressivity

- ▶ Show effects of policy change on key economic variables

Model Features

- Demographics: Overlapping generations, married/non-married households, population growth

- Risk: survival, labor productivity, rental shock

- Discrete choice in every period: Rent or own

- Taxes: Federal income tax (rigorous deductions), sales, and property

Owner's Bellman Equation

$$V_O^m(j, a, h, \epsilon) = \max_{a', h', n} u(\tilde{c}, 1 - n)$$
$$+ s_{j+1}\beta E_{\{\epsilon'|\epsilon\}} \left[(1 - p_R)V^m(j + 1, a', h', \epsilon') + p_R V_R^m(j + 1, a', h', \epsilon') \right]$$

s.t. $c = (1+r)a - a' + (1-\delta_h)h - h' - \Phi(h, h') + \epsilon(1+g)^j n + \mathbf{1}_{\{j \geq T_r\}} ss - \tau$

$$a' \geq -(1 - \theta)h'$$

$$(1 - \delta_h)h' + a' \geq 0$$

$$h' \geq \underline{h}$$

$$n \in [0, 1]$$

$$\tau = \tau_m^f(y_m^f) + \tau_{ss} \min\left\{ \epsilon(1 + g)^j n, \bar{y}^{ss} \right\} + \tau_m \epsilon(1 + g)^j n$$
$$+ \tau_m^s(y_m^s) + \tau_c c + \tau_p(h')$$

Renter's Bellman Equation

$$V_R^m(j, a, h, \epsilon) = \max_{a', e, n} u(\tilde{c}, 1 - n)$$

$$+ s_{j+1}\beta E_{\{\epsilon'|\epsilon\}} \left[(1 - p_R)V^m(j + 1, a', 0, \epsilon') + p_R V_R^m(j + 1, a', 0, \epsilon') \right]$$

$$\text{s.t. } c = (1 + r)a - a' - q^R e - \Phi(h, 0) + \epsilon(1 + g)^j n + \mathbf{1}_{\{j \geq T_r\}} ss - \tau$$

$$a' \geq 0$$

$$e \geq 0$$

$$n \in [0, 1]$$

$$\tau = \tau_m^f(y_m^f) + \tau_{ss} min \left\{ \epsilon(1 + g)^j n, \bar{y}^{ss} \right\} + \tau_m \epsilon(1 + g)^j n$$
$$+ \tau_m^s(y_m^s) + \tau_c c$$

Housing Decision

- If no rental shock:

$$V^m(j, a, h, \epsilon) = \max \left\{ V_O^m(j, a, h, \epsilon), V_R^m(j, a, h, \epsilon) \right\},$$

- and if rental shock:

$$V^m(j, a, h, \epsilon) = V_R^m(j, a, h, \epsilon)$$

Federal Income Tax

- Federal income tax function $\tau_m^f(y_m^f)$

- Taxable income:

$$y = \max\{ra, 0\} + \epsilon(1+g)^j n + \mathbf{1}_{\{j \geq T_r\}} ss,$$

- Federal tax deduction:

$$D_m^f(a, h') = \max\left\{ |\min\{ra, 0\}| + \tau_p(h'), \bar{D}_m^f \right\}.$$

- Taxable income:

$$y_m^f = \max\left\{ y - D_m^f(a, h'), 0 \right\}$$

Texas Property Tax

- Property tax features:
  - Property tax divided into M&O and non-M&O components: $\tau_{p,MO}$ and τ_p.

  - All home owners have homestead exemptions h^E.

  - Retired home owners have additional exemption on M&O tax: h^{MO}.

- Texas property tax bill:

$$\tau_p max \left\{ h' - h^E, 0 \right\} + \tau_{p,MO} max \left\{ h' - h^E - \mathbf{1}_{\{j \geq T_r\}} h^{MO}, 0 \right\}$$

Functional Forms

- Utility:

$$u(\tilde{c}, 1-n) = \frac{\left(\tilde{c}^{\chi}(1-n)^{1-\chi}\right)^{1-\sigma}}{1-\sigma},$$

$$\tilde{c} = \left(\omega c^{\eta} + (1-\omega)h^{\eta}\right)^{\frac{1}{\eta}}.$$

- Federal Income Tax $\rightarrow$ Gouveia-Strauss:

$$\tau_m^f(y) = \kappa_0^m\left(y - \left(y^{-\kappa_1^m} + \kappa_2^m\right)^{-\frac{1}{\kappa_1^m}}\right).$$

- Housing adjustment costs:

$$\Phi(h, h') = \begin{cases} 0 & \text{if } \mid h - h' \mid \leq \phi h \\ \rho_s h + \rho_b h' & \text{if } \mid h - h' \mid > \phi h \end{cases}$$

Parameterization

Table 1: Model Parameters

Parameter	Value	Target/Source
Preferences		
Consumption share (χ)	0.25	Average hours
Risk aversion (σ)	3.5	Elas. of Intertemporal Sub.
Discount factor (β)	1.06	Life-cycle ownership rate
Elasticity of substitution (η)	0.145	Ogaki and Reinhart (1998)
Non-housing consumption weight (ω)	0.79	Housing distribution
Demographics		
Maximum lifetime (T)	46	Assumed
Retirement age (T_r)	80	Assumed
Survival probability (s_{j+1})	(See source)	CDC Life Tables (2008)
Population growth (ν)	0.012	Attanasio, et al. (2010)
Marriage probability (p_m)	0.524	CPS data
Housing		
Down payment (θ)	10%	Yang (2009)
Rental shock probability (p_R)	12%	Ownership rate
Minimum house value ($\underline{h}$)	$1 \times$ per capita income	Housing distribution
Housing depreciation (δ_h)	1.4%	Yang (2009)
Buying costs (ρ_b)	7.0%	Yang (2009)
Selling costs (ρ_s)	2.5%	Yang (2009)
Maximum cost-free value change (ϕ)	7.0%	Yang (2009)
Labor Productivity		
Variance of entering workers (σ_y^2)	0.38	Huggett (1996)
Persistence (ρ)	0.96	Huggett (1996)
Variance of innovation (σ_ε^2)	0.045	Huggett (1996)

Policy Parameters

Table 2: Policy Parameters

Parameter	Value
τ_c	8.25% (30% base)
$\tau_{p,MO}$	1.07%
τ_p	0.83%
h^E	$25,000
h^{MO}	$10,000

Texas Productivity Profile
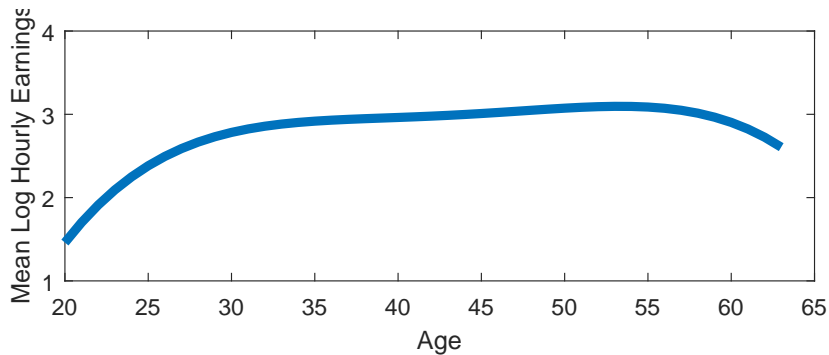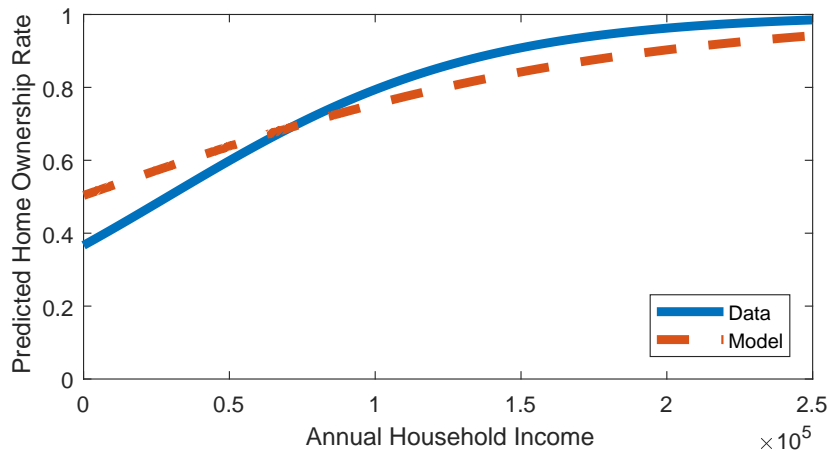
Income Distribution
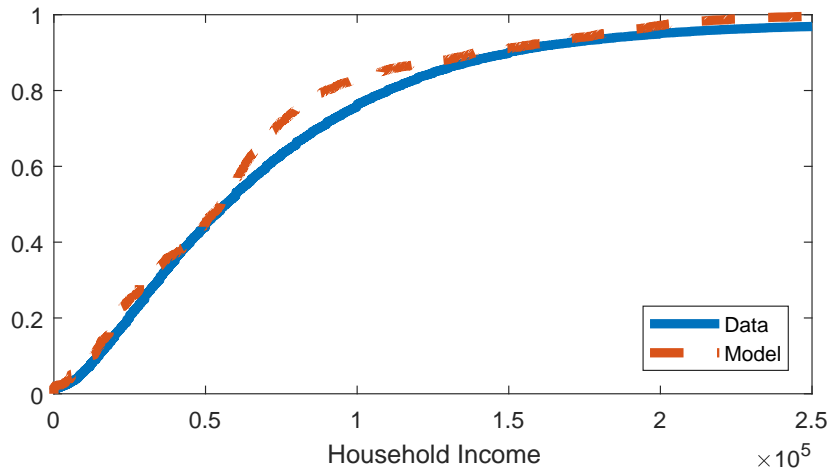
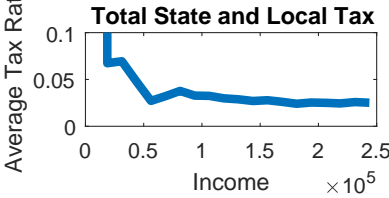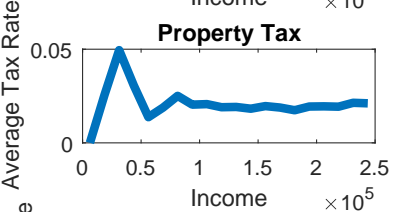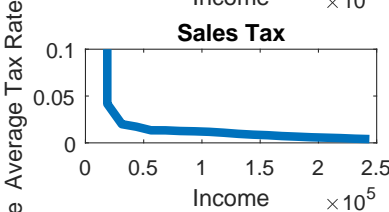# Housing Distribution
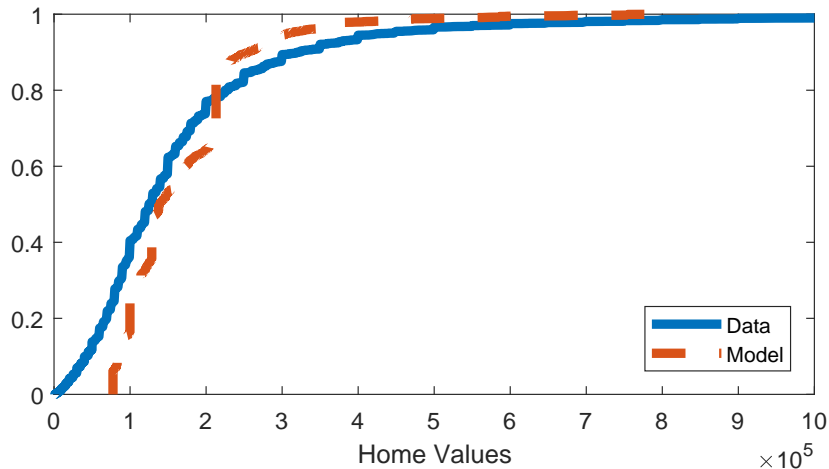
Life-cycle Ownership
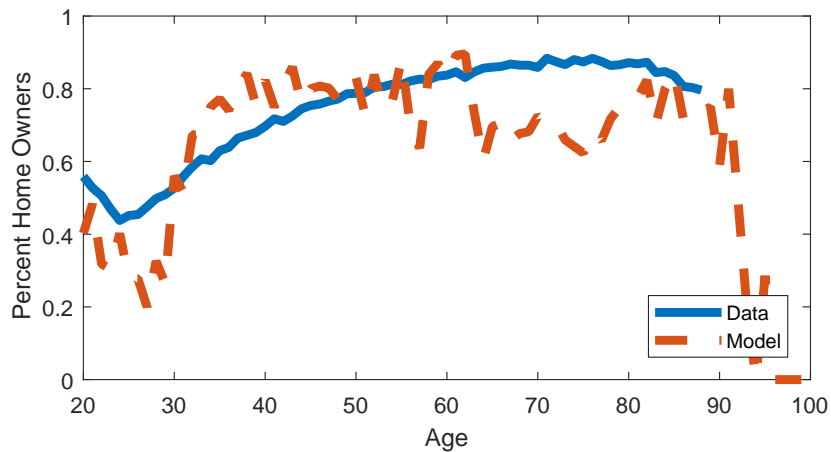
Ownership Rate by Income

Table 3: Comparing Housing Data to Model Values

Moment	Data (Source)	Model
Home Ownership Rate	64.9% (CPS)	64.6%
Mean Home Value	$174,550 (ACS)	$167,550
Median Home Value	$125,000 (ACS)	$138,820
Average Annual Property Tax	$2,927 (CPS)	$2,686

Benchmark Progressivity
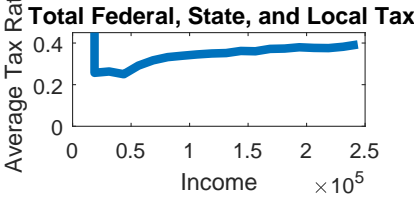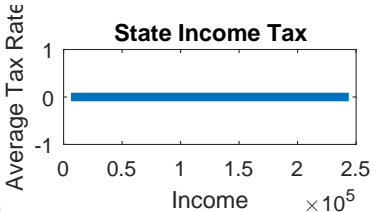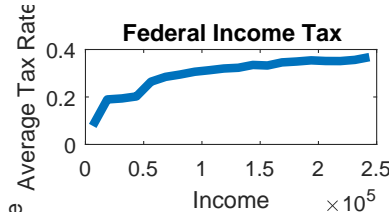
Tax Progressivity Composition
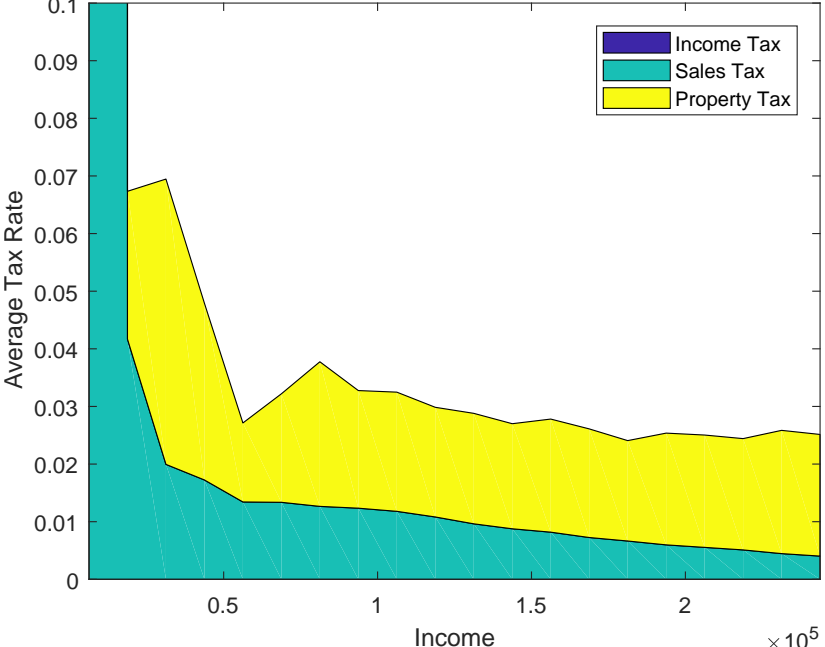
Counterfactual Experiment

- Policy experiment: eliminate the M&O portion of the property tax, raise the sales tax to maintain budget neutrality.

- Results of policy experiment depend on whether rental market absorbs the property tax change.

    - Case #1: Rental price unaffected

    - Case #2: Rental price fully affected

Results Comparison

Table 4: Effects of Policy Reform

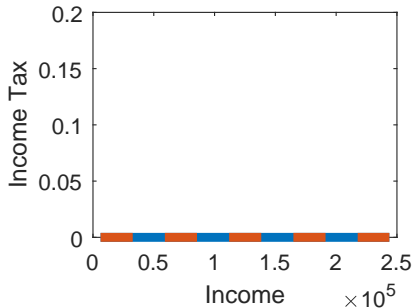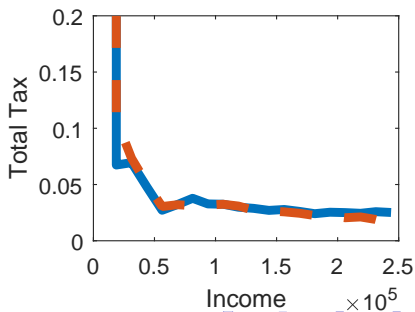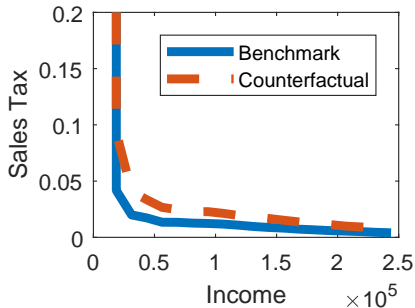|	Rental Unaffected	Rental Fully Affected
τ_c (30% base)	14.99%	15.99%
%Δ Hours Worked	-0.888	-0.002
%Δ Per-capita Income	-2.877	-1.070
Ppt. Δ Ownership Rate	6.909	-10.058
%Δ Average Home Value	10.025	28.182
%Δ Welfare	0.802	1.376

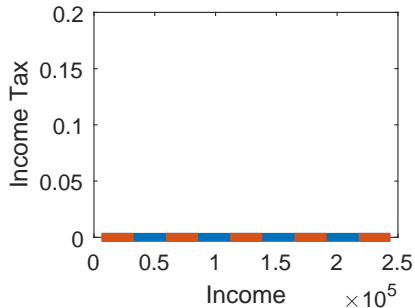# Rental Unaffected: Tax Rate/Base Trade-off
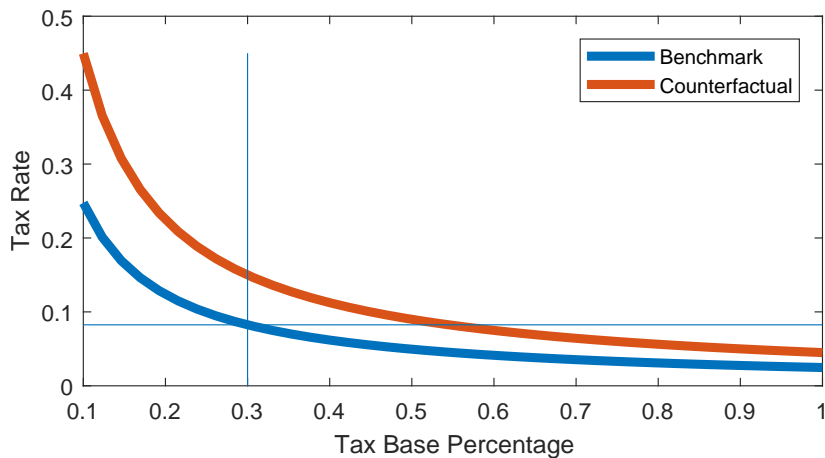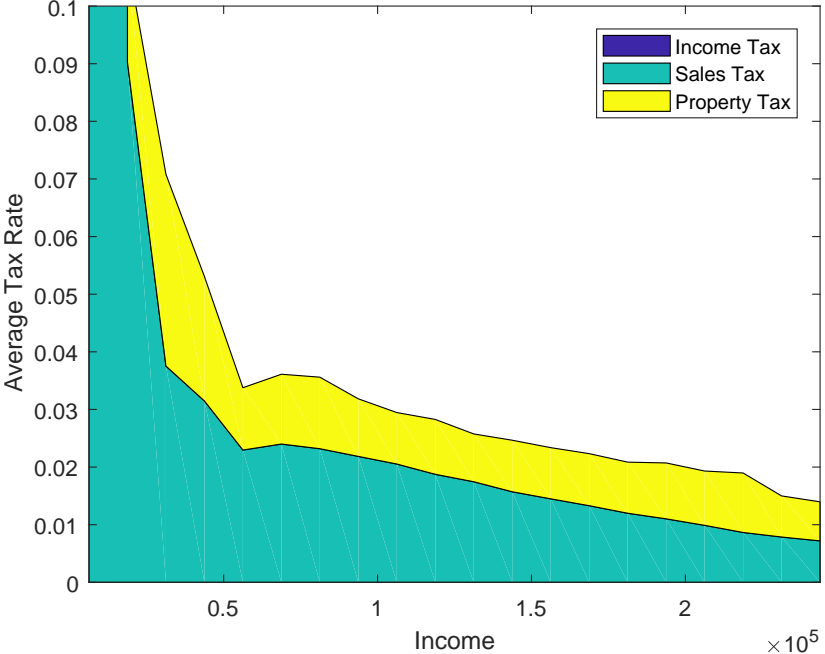
Rental Fully Affected: Tax Rate/Base Trade-off
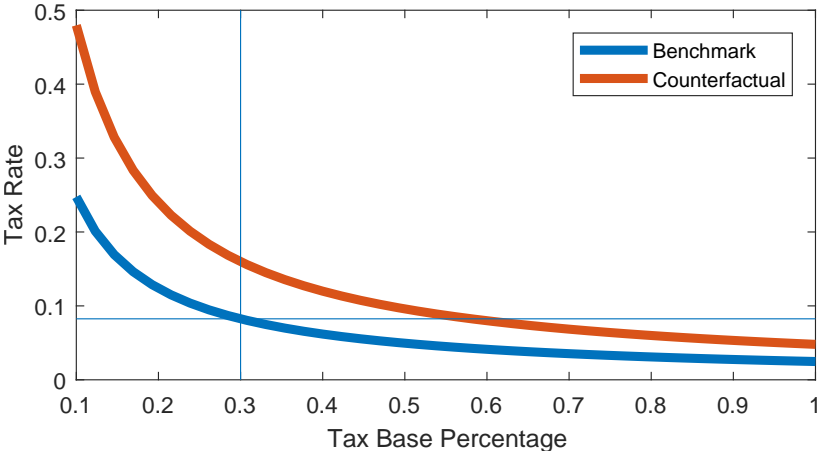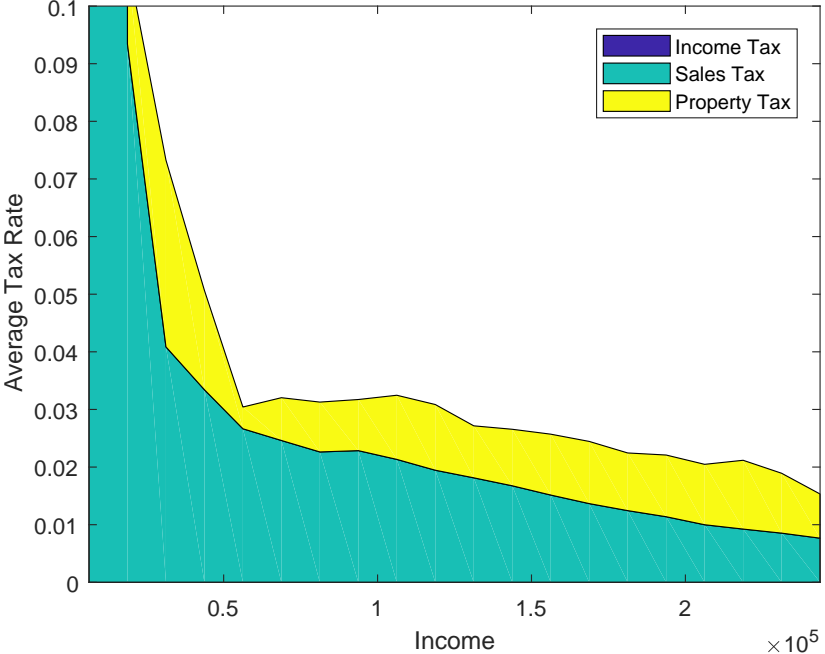
Rental Unaffected: State Tax Progressivity
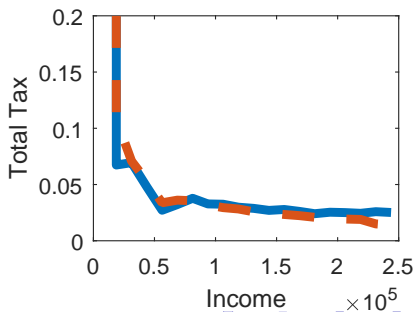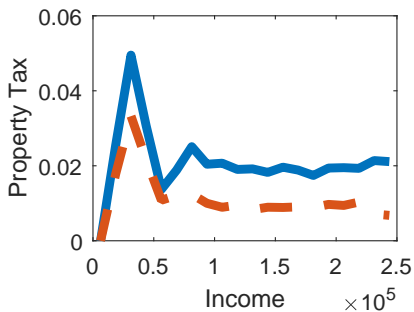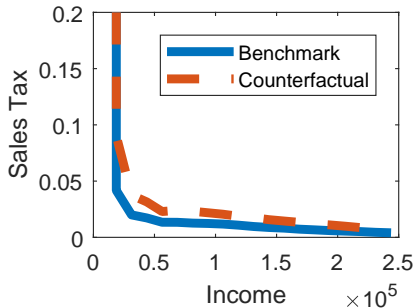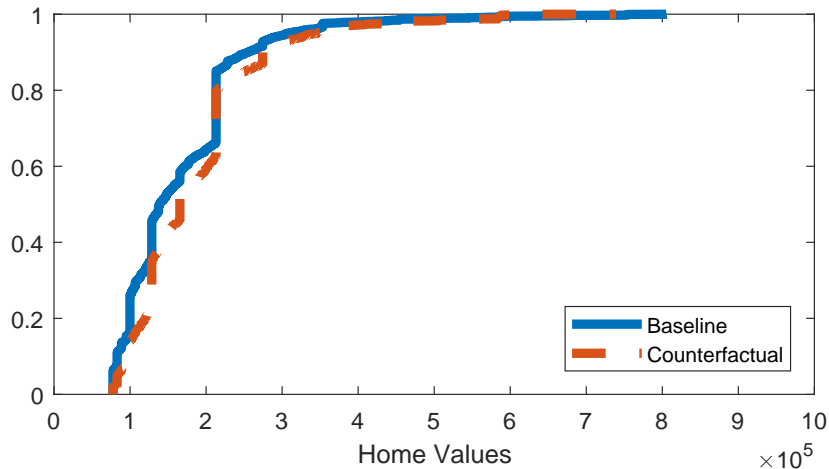
Rental Fully Affected: State Tax Progressivity
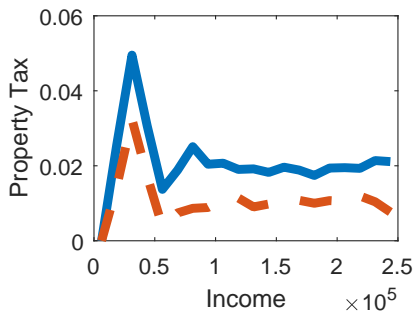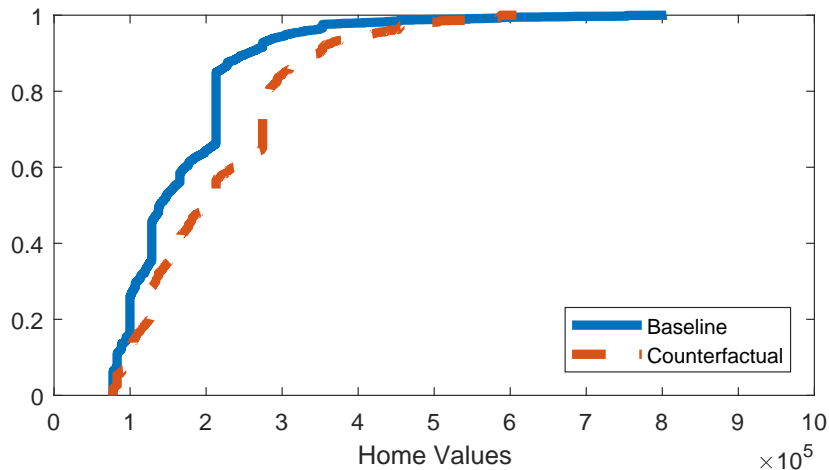
Rental Unaffected: Effective Tax Composition

Rental Fully Affected: Effective Tax Composition

Rental Unaffected: Housing

Rental Fully Affected: Housing

Conclusion

- ▶ Dynamic model measures economic consequences of fiscal reform.

- ▶ Baseline model replicates several moments of the Texas economy.

- ▶ Alternative assumptions imply different economic consequences.

- ▶ Either assumption results in welfare improvements from reducing property taxation.