Housing and Tax-deferred Retirement Accounts

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The views expressed here are those of the authors and do not represent the views of the Bank of Canada.
Assets in tax-deferred accounts (TDA) and housing wealth are two major assets in household portfolio.

- Common types of TDA in the US: defined contribution (DC) pension plans (401(k), 403(b), 457) and Individual Retirement Accounts (IRA)
- Over 50% of US households have TDA
  Assets in TDA: $8.6T ($11.9T) in 2007 (2013)
- Home ownership in the US: 68% (65%) in 2007 (2013)
- Housing is the single most important asset for a typical household
  Guiso, Jappelli, and Haliassos (2001), Sinai and Souleles (2007)
TDA in the US
- Contributions to TDA are deductible from taxable income
- Capital income for assets in TDA is tax exempted
- Subsequent asset withdrawals are taxed as ordinary income

Liquidity risk: Early withdrawal of TDA assets receives a 10% penalty

Does TDA wealth represent new savings?
- Gale and Scholz (1994); Poterba, Venti, and Wise (1995); Imrohoroglu, Imrohoroglu, and Joines (1998); Laibson, Repetto, Tobacman (1998); Kitao (2010); Nishiyama (2011)

Portfolio choice in presence of TDA
- Amromin (2003); Dammon, Spatt, and Zhang (2004); Zhou (2009)
Preferential tax treatments on home ownership:
- Mortgage interest and property tax are income tax deductible in the US
- Costs of housing service for homeowners lower than rental costs
- Untaxed capital gains (up to a limit) from housing
- Untaxed service flow from owners-occupied housing

Down payment requirement and high transaction costs

Literature on preferential tax treatment of housing, interactions between housing and non-housing consumption, housing and B.C.
Gervais (2002); Li and Yao (2007); Yang (2009); Chen (2010); Iacoviello and Pavan (2013); Halket and Vasudev (2014)

Impact of housing on asset allocation:
Cocco (2005); Yao and Zhang (2005); Becker and Shabani (2010); Chetty and Szeidl (2014)
TDA and home ownership share similarities in terms of favorable tax treatments and liquidity risk.

Interactions between housing tenure choice and households’ use of TDA? Joint decisions.
- Holdings in TDA remained low (Munnell (2012), Poterba (2014))
- Home ownership may affect HHs’ use of TDA due to down payment requirement and committed mortgage payments
- TDA may affect HH mortgage and home ownership

Existing literature treats these assets separately.

Research on TDA with housing is about tax arbitrage:
- Mortgage prepayment vs. TDA contribution
  Amromin, Huang, and Sialm (2007)
- Asset allocation (fixed TDA contribution & maximum mortgage)
  Marekwica, Schaefer, and Sebastian (2013)
What We Do

- **Survey of Consumer Finance (SCF) data:**
  - Focus on households with TDA
  - Document patterns of cross-sectional variation in net worth composition regarding home equity, TDA wealth and TA wealth

- **Model:**
  - Study the joint decisions of housing tenure choice and households’ use of TDA
  - Evaluate household behavior in the counterfactual experiments (TDA-related policies and housing-related factors)
Figure: Home ownership for DC participants: average in 2001–2007 SCF
Figure: Net worth composition for homeowners: DC participants
Main Findings

- Benchmark model matches well with the life-cycle patterns of home ownership rate and homeowners’ net worth composition.
- TDA promotes home ownership (i.e., households borrow earlier and pay lower down payments) and household debt (mortgages).
- An increase in min. down payment ratio has a large impact on young households (home ownership ↓ and TA share ↑), but little impact on older households.
- When mortgage interest payments and property taxes are not income tax deductible, home ownership drops significantly, while households do not increase their use of TDA.
- Eliminating social security system increases home ownership, but decreases the importance of home equity and TDA in net worth composition.
Model: Key Features

- Discrete time life-cycle model
- Aggregate and idiosyncratic income shocks
- Long-term mortgage arrangement (no mortgage default and refinancing)
- Households have access to both TA and TDA
- Social security system and progressive income tax system that mimics the U.S. tax codes
- Households make decisions on:
  1. TDA and TA savings, 2. housing tenure choice, 3. house size, 4. down payment, and 5. consumption
Preferences

- Stochastic lifetime and at most live for $J$ periods
- Households’ preferences are represented by

$$E_1 \sum_{j=1}^{J} \beta^{j-1} \left\{ \prod_{t=1}^{j} s_t \frac{(c_j^{1-\omega} h_j^\omega)^{1-\gamma}}{1-\gamma} + (1 - \prod_{t=1}^{j} s_t) \frac{(W_j)^{1-\gamma}}{1-\gamma} \right\}$$ (1)

$0 < \beta < 1$: the discount factor
$\gamma$: the relative risk aversion
$s_t$: conditional survival probability in period $t$
$\omega$: preference for housing
$W_j$: the estate when a household dies in period $j$
Households supply labor inelastically to work in first R periods of life.

Household $i$ at age $j$ receives stochastic labor income $Y_{ij}$ such that

$$\ln(Y_{ij}) = y_{ij} = f_{ij} + \eta_j + \varepsilon_{ij}$$

(2)

$f_{ij}$: the deterministic hump-shape age earnings profile

$\eta_j$: aggregate shock among all households

$\varepsilon_{ij}$: idiosyncratic persistent shock

Both $\eta_j$ and $\varepsilon_{ij}$ follow AR(1) processes

$$\eta_{j+1} = \rho_{\eta} \eta_j + \xi_{j+1}^\eta, \text{ with i.i.d. } \xi_{j}^\eta \sim N(0, \sigma_{\eta}^2)$$

(3)

$$\varepsilon_{ij+1} = \rho_{\varepsilon} \varepsilon_{ij} + \xi_{j+1}^\varepsilon, \text{ with i.i.d. } \xi_{j}^\varepsilon \sim N(0, \sigma_{\varepsilon}^2)$$

(4)

Aggregate shock and idiosyncratic shock are uncorrelated.
After $R$ working periods, households retire and receive retirement income.

Retirement income is modeled as

$$y_{ij} = \log(\lambda) + f_{iR} + \varepsilon_{iR}$$

where $\lambda$ is a constant fraction.
Size of housing services: $H = \{H_1, H_2, H_3, H_4, H_5\}$

$P_j$ is the price per unit of housing in terms of consumption goods. Hence, the value of a house of size $h$ is $P_j h$ in period $j$.

Let $p_j = \log(P_j)$, and $\tilde{p}_j = p_j - g(j - 1)$ be the detrended log price of housing.

We assume aggregate labor income shocks and housing price shocks are perfectly correlated (Cocco 2005).
Housing services can be obtained by owning \((DR = 0)\) or renting \((DR = 1)\)

For \(j \leq R\), households can choose to be a renter or an owner.

For \(j > R\), homeowners decide whether to stay in the same house, downsize to own a smaller house, or become a renter. Renters can only rent and choose the size of the rental property.

Differences in house size for rental and owner-occupied housing.

Generally rental housing are smaller units (Gervais 2002)

\[
h_j = \begin{cases} 
H_1, H_2, H_3 & \text{if } DR = 1 \\
H_2, H_3, H_4, H_5 & \text{if } DR = 0 
\end{cases}
\]
Renters pay $\phi$ of the house value as rental cost per period.

Buying a house requires a $N$-period mortgage loan with fixed mortgage interest rate $r_m$.

Require $\theta^D$ fraction of the house value as down payment.

$$
\theta^D = \begin{cases} 
\in \{0.1, 0.2, 0.5, 0.75, 1.0\} & \text{if } j \leq R \\
= 1 & \text{if } j > R 
\end{cases}
$$

(7)
The initial loan principle \( L \) is given by

\[
L = \begin{cases} 
(1 - \theta^D) e^{g(n-1)} + \bar{p}_n h & \text{if } n \in [1, R] \\
0 & \text{otherwise}
\end{cases} 
\]  

(8)

where \( n \) is the period in which a household buys a house.

The mortgage payment is defined as

\[
M_j = \begin{cases} 
\frac{r_m L (1+r_m)^N}{(1+r_m)^N-1} & \text{if } n \in [1, R] \text{ and } n \leq j \leq (n + N - 1) \\
0 & \text{otherwise}
\end{cases} 
\]  

(9)
The principle payment ($E$) in period $j$ is

$$E_j = \begin{cases} \frac{r_m L (1+r_m)^{j-n}}{(1+r_m)^N - 1} & \text{if } n \in [1, R] \text{ and } n \leq j \leq (n + N - 1) \\ 0 & \text{otherwise} \end{cases} \quad (10)$$

The interest payment ($I$) in period $j$ is

$$I_j = \begin{cases} \frac{r_m L [(1+r_m)^N - (1+r_m)^{j-n+1}]}{(1+r_m)^N - 1} & \text{if } n \in [1, R] \text{ and } n \leq j \leq (n + N - 1) \\ 0 & \text{otherwise} \end{cases} \quad (11)$$

The remaining loan principle ($LL$) is

$$LL_j = \begin{cases} \frac{L [(1+r_m)^N - (1+r_m)^{j-n+1}]}{(1+r_m)^N - 1} & \text{if } n \in [1, R] \text{ and } n \leq j \leq (n + N - 1) \\ 0 & \text{otherwise} \end{cases} \quad (12)$$
• Annual maintenance costs is $\delta$ of the house value
• Property tax rate is $\tau$
• Transaction cost of buying a house is $\theta^B$ fraction of the house value
• Transaction cost of selling a house is $\theta^S$ fraction of the house value
• The household expenditure on housing ($x_j$) is given by

\[
x_j = \begin{cases} 
\phi P_j h & \text{if } DR_{j-1} = DR_j = 1 \\
\phi P_j h_j + LL_{j-1} - (1 - \theta^S) P_j h_{j-1} & \text{if } DR_{j-1} = 0 \text{ and } DR_j = 1 \\
M_j + (\theta^B + \theta^D + \tau + \delta) P_j h_j & \text{if } DR_{j-1} = 1 \text{ and } DR_j = 0 \\
M_j + (\tau + \delta) P_j h_j & \text{if } DR_{j-1} = DR_j = 0 \text{ and } h_j = h_{j-1} \\
M_j + (\theta^B + \theta^D + \tau + \delta) P_j h_j + LL_{j-1} - (1 - \theta^S) P_j h_{j-1} & \text{if } DR_{j-1} = DR_j = 0 \text{ and } h_j \neq h_{j-1} 
\end{cases}
\]  

(13)
Tax-deferred Account (TDA) I

- For age $j \leq R$, households can contribute their pre-tax labor income to TDA, up to $\bar{q} = 8\%$ of labor income.
- Assets in TDA can be withdrawn prior to retirement age at the cost of a penalty rate $pen = 10\%$ in addition to the ordinary income tax incurred.
- For age $j > R$, household decides the amount withdrawn from TDA.
- Pays tax on the withdrawals at the ordinary income tax rate.
- $q_j$ is a household's contributions to (withdrawal from) TDA.

$$q_j \begin{cases} \in [-a_j^D, \bar{q} \ast Y_j] & \text{if } j \leq R \\ \in [-a_j^D, 0] & \text{if } j \geq R + 1 \text{ and } j \leq R + 6 \\ \in [-a_j^D, -\frac{1}{j-j+1} a_j^D] & \text{if } j > R + 6 \end{cases}$$ (14)

where $a_j^D$ is the amount of assets in TDA.
Employers match 33.3% of employee’s contribution

Only applies up to 6% of an employee’s labor income

The employer’s contribution \( q^E_j \) is

\[
q^E_j = \begin{cases} 
\min(0.333 \times q_j, 0.333 \times 0.06 \times Y_j) & \text{if } j \in [1, R] \text{ and } q_j > 0 \\
0 & \text{otherwise}
\end{cases}
\]

(15)

Assets earn a constant rate of return, \( r \), in both TDA and TA. The law of motion of assets in TDA is

\[
a^D_{j+1} = \begin{cases} 
(1 + r)(a^D_j + q_j + q^E_j) & \text{if } j \leq R \\
(1 + r)(a^D_j + q_j) & \text{if } j > R
\end{cases}
\]

(16)
Taxable Account (TA)

- $a_j^T$ is the financial wealth in the TA plus current labor income. The law of motion of assets in the TA is

$$a_{j+1}^T = (1 + r) \left[ a_j^T - c_j - x_j - q_j - \Gamma_j \right] + Y_{j+1} \quad (17)$$

- Both TDA and TA are subject to zero borrowing constraint

$$a_j^T \geq Y_j \text{ and } a_j^D \geq 0 \text{ for all } j \quad (18)$$

- Households are randomly endowed with initial wealth $a_0^T$ when they are born

- The bequest left by a household is

$$W_j = \begin{cases} a_j^T + a_j^D + (1 - \theta^S)P_j h_{j-1} - LL_{j-1} & \text{if } DR_{j-1} = 0 \\ a_j^T + a_j^D & \text{if } DR_{j-1} = 1 \end{cases} \quad (19)$$
Income is taxed through a piece-wise linear progressive tax system.

Adjusted gross income (AGI) is defined as

\[
\text{AGI}_j = \begin{cases} 
    r \left( \frac{a_T - Y_j}{1+r} \right) + Y_j - q_j - l_j - \tau P_j h & \text{if } DR_j = 0 \\
    r \left( \frac{a_T - Y_j}{1+r} \right) + Y_j - q_j & \text{if } DR_j = 1 
\end{cases}
\]

Here, \( \tau_1, \tau_2, \tau_3, \tau_4, \) and \( \tau_5 \) denote corresponding marginal tax rates.

Suppose \( \text{AGI}_j \in (IC_3, IC_4] \), then

\[
T(\text{AGI}_j) = \tau_1 (IC_2 - IC_1) + \tau_2 (IC_3 - IC_2) + \tau_3 (\text{AGI}_j - IC_3)
\]
• $\tau_{ss}$ is the payroll tax rate and $Y_{ss}$ be the earnings limit up to which earnings are subject to payroll tax.

• For households who withdraw funds from TDA before age $R - 4$, the penalty payment incurred is also included in the tax payments.

• The total tax liability of a household is defined as

$$\Gamma_j = \begin{cases} 
T(AGI_j) + \min(\tau_{ss} * Y_j, \tau_{ss} * Y_{ss}) - pen * q_j & \text{if } q_j < 0 \text{ and } j < (R - 4) \\
T(AGI_j) + \min(\tau_{ss} * Y_j, \tau_{ss} * Y_{ss}) & \text{otherwise}
\end{cases}$$

(21)
A household’s decision problem in recursive form is written as

\[
V(j, \eta_j, \varepsilon_j, a_j^T, a_j^D, DR_{j-1}, h_{j-1}, n, \tilde{p}_n, \theta_n^D) = \max_{c_j, q_j, DR_j, h_j, \theta_n^D} \frac{\left( c_j^{1-\omega} h_j^\omega \right)^{1-\gamma}}{1-\gamma} \]

\[
+ \beta s_{j+1} E_j \left[ V(j + 1, \eta_{j+1}, \varepsilon_{j+1}, a_{j+1}^T, a_{j+1}^D, DR_j, h_j, n, \tilde{p}_n, \theta_n^D) \right] \\
+ \beta (1 - s_{j+1}) \frac{(W_{j+1})^{1-\gamma}}{1-\gamma} \tag{22}
\]

subject to constraints given by (6) to (21) and the labor income process given by (2) to (5), in addition to the non-negativity constraint on consumption.
All nominal variables are normalized to 2007 values.

Monetary variable are expressed as multiples of median income in period 1 ($38,000 = 1)

Housing sizes are \{2, 4, 6, 8, 10\} times of period 1 median income

We use year 2000 income tax code

**Table:** Cutoff Points and Marginal Tax Rate

<table>
<thead>
<tr>
<th>Taxable Income (AGI)</th>
<th>Normalized Income</th>
<th>Marginal Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>($0, $5600]</td>
<td>(0, 0.187]</td>
<td>0%</td>
</tr>
<tr>
<td>($5600, $45600]</td>
<td>(0.187, 1.520]</td>
<td>15%</td>
</tr>
<tr>
<td>($45600, $105600]</td>
<td>(1.520, 3.520]</td>
<td>28%</td>
</tr>
<tr>
<td>($105600, $155600]</td>
<td>(3.520, 5.187]</td>
<td>31%</td>
</tr>
<tr>
<td>($155600, $265600]</td>
<td>(5.187, 8.853]</td>
<td>36%</td>
</tr>
<tr>
<td>$265600 +</td>
<td>8.853 +</td>
<td>39.60%</td>
</tr>
</tbody>
</table>
### Table: Summary of Parameter Values I

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Values</th>
<th>Target / Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$J$</td>
<td>Lifespan</td>
<td>71</td>
<td>Real age 25–95</td>
</tr>
<tr>
<td>$R$</td>
<td>Last working period</td>
<td>40</td>
<td>Work until age 64</td>
</tr>
<tr>
<td>$s$</td>
<td>Survival probability</td>
<td></td>
<td>Life table 2000</td>
</tr>
<tr>
<td>Preferences</td>
<td></td>
<td></td>
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<tr>
<td>$\gamma$</td>
<td>Relative risk aversion</td>
<td>2</td>
<td></td>
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<tr>
<td>$\beta$</td>
<td>Discount factor</td>
<td>0.96</td>
<td>Li and Yao (2007)</td>
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<tr>
<td>$\omega$</td>
<td>Preferences on housing</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$f$</td>
<td>Age earnings profile</td>
<td></td>
<td>Cocco et al. (2005)</td>
</tr>
<tr>
<td>$\rho_{\eta}$</td>
<td>Persistence of aggr. income shock</td>
<td>0.748</td>
<td>Cocco (2005)</td>
</tr>
<tr>
<td>$\sigma_{\eta}$</td>
<td>s.d. aggregate income shock</td>
<td>0.019</td>
<td>Cocco (2005)</td>
</tr>
<tr>
<td>$\rho_{\varepsilon}$</td>
<td>Persistence of idio. income shock</td>
<td>0.973</td>
<td>Heathcote et al. (2010)</td>
</tr>
<tr>
<td>$\sigma_{\varepsilon}$</td>
<td>s.d. idiosyncratic income shock</td>
<td>0.133</td>
<td>Heathcote et al. (2010)</td>
</tr>
<tr>
<td>$\lambda_{\text{COL}}$</td>
<td>Income replacement rate</td>
<td>0.4</td>
<td>Diaz and Luengo-Prado (2008)</td>
</tr>
<tr>
<td>$\lambda_{\text{HS}}$</td>
<td>Income replacement rate</td>
<td>0.6</td>
<td>Diaz and Luengo-Prado (2008)</td>
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</table>
### Table: Summary of Parameter Values II

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Name</th>
<th>Values</th>
<th>Target / Data Source</th>
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<tbody>
<tr>
<td><strong>Savings</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>Return on saving</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Housing &amp; mortgage</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>$N$</td>
<td>Mortgage length</td>
<td>30</td>
<td>Chambers et al. (2009)</td>
</tr>
<tr>
<td>$r_m$</td>
<td>Mortgage interest rate</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td>$g$</td>
<td>House price growth rate</td>
<td>1%</td>
<td>Cocco (2005)</td>
</tr>
<tr>
<td>$\sigma_\bar{p}$</td>
<td>s.d. house prices</td>
<td>6.2%</td>
<td>Cocco (2005)</td>
</tr>
<tr>
<td>$\theta^S$</td>
<td>House trans. cost for seller</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>$\theta^B$</td>
<td>House trans. cost for buyer</td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>$\tau$</td>
<td>Property tax rate</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>$\delta$</td>
<td>Housing maintenance cost</td>
<td>1.5%</td>
<td>Yao and Zhang (2005)</td>
</tr>
<tr>
<td>$\phi$</td>
<td>Rental cost of housing</td>
<td>6.5%</td>
<td></td>
</tr>
<tr>
<td><strong>TDA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\bar{q}$</td>
<td>Contributions limit</td>
<td>8%</td>
<td>Joulfaian and Richardson (2001)</td>
</tr>
<tr>
<td>$pen$</td>
<td>Penalty rate</td>
<td>10%</td>
<td>Zhou (2009)</td>
</tr>
<tr>
<td><strong>Tax code</strong></td>
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</tr>
<tr>
<td>$\tau_{ss}$</td>
<td>Payroll tax rate</td>
<td></td>
<td>Historical OASDI tax rate</td>
</tr>
<tr>
<td>$Y_{ss}$</td>
<td>Earnings limit for payroll</td>
<td></td>
<td>Historical earnings limit</td>
</tr>
</tbody>
</table>
Figure: Home ownership rate for DC participants
Figure: Net worth composition for homeowners
List of Experiments

- TDA policies
  - No employer matching
  - Eliminating TDA *
  - Higher TDA contribution limit

- Housing-related factors
  - Increasing min. down payment *
  - Increasing rental costs
  - No tax benefits for home ownership *

- Eliminating social security *
Values for the benchmark model are normalized to 1

<table>
<thead>
<tr>
<th>Age Group</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net worth</td>
<td>0.468</td>
<td>0.758</td>
<td>0.878</td>
<td>0.872</td>
<td>0.818</td>
</tr>
<tr>
<td>TDA/net worth</td>
<td>·</td>
<td>·</td>
<td>·</td>
<td>·</td>
<td>·</td>
</tr>
<tr>
<td>TA/net worth</td>
<td>7.981</td>
<td>8.355</td>
<td>3.270</td>
<td>4.969</td>
<td>7.781</td>
</tr>
<tr>
<td>% of home ownership</td>
<td>0.380</td>
<td>0.564</td>
<td>0.746</td>
<td>0.900</td>
<td>0.685</td>
</tr>
<tr>
<td>Median income of owners</td>
<td>1.122</td>
<td>1.261</td>
<td>1.085</td>
<td>1.020</td>
<td>1.114</td>
</tr>
<tr>
<td>Home equity/net worth</td>
<td>1.169</td>
<td>1.376</td>
<td>1.478</td>
<td>1.410</td>
<td>1.363</td>
</tr>
<tr>
<td>Home equity/home value</td>
<td>1.504</td>
<td>2.414</td>
<td>1.520</td>
<td>1.053</td>
<td>1.765</td>
</tr>
</tbody>
</table>
Increase min. down payment to 20%

Values for the benchmark model are normalized to 1

<table>
<thead>
<tr>
<th></th>
<th>Age Group</th>
<th></th>
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<th>Overall</th>
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<tr>
<td></td>
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<td>35-44</td>
<td>45-54</td>
<td>55-64</td>
<td></td>
</tr>
<tr>
<td>Net worth</td>
<td>0.885</td>
<td>0.997</td>
<td>0.995</td>
<td>0.995</td>
<td>0.998</td>
</tr>
<tr>
<td>TDA/net worth</td>
<td>1.117</td>
<td>0.938</td>
<td>0.967</td>
<td>0.985</td>
<td>0.981</td>
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<tr>
<td>TA/net worth</td>
<td>1.378</td>
<td>1.212</td>
<td>1.081</td>
<td>1.073</td>
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</tr>
<tr>
<td>% of home ownership</td>
<td>0.728</td>
<td>0.924</td>
<td>0.982</td>
<td>0.998</td>
<td>0.932</td>
</tr>
<tr>
<td>Median income of owners</td>
<td>1.070</td>
<td>1.032</td>
<td>1.009</td>
<td>1.000</td>
<td>1.023</td>
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<tr>
<td>Home equity/net worth</td>
<td>1.044</td>
<td>1.037</td>
<td>1.011</td>
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<tr>
<td>Home equity/home value</td>
<td>1.339</td>
<td>1.094</td>
<td>0.997</td>
<td>0.957</td>
<td>1.062</td>
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</tbody>
</table>
No tax benefits for home ownership

Values for the benchmark model are normalized to 1

<table>
<thead>
<tr>
<th></th>
<th>Age Group</th>
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<tbody>
<tr>
<td></td>
<td>25-34</td>
<td>35-44</td>
<td>45-54</td>
<td>55-64</td>
<td>Overall</td>
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<tr>
<td>Net worth</td>
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<td>0.892</td>
<td>0.946</td>
<td>0.971</td>
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<tr>
<td>TDA/net worth</td>
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<tr>
<td>TA/net worth</td>
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<td>1.304</td>
<td>0.990</td>
<td>1.230</td>
<td>1.191</td>
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<tr>
<td>% of home ownership</td>
<td>0.600</td>
<td>0.756</td>
<td>0.864</td>
<td>0.918</td>
<td>0.810</td>
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<td>Median income of owners</td>
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<td>1.020</td>
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<td>Home equity/net worth</td>
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<td>1.131</td>
<td>1.107</td>
<td>1.040</td>
<td>1.065</td>
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<td>Home equity/home value</td>
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<td>1.248</td>
<td>1.394</td>
<td>1.053</td>
<td>1.450</td>
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Values for the benchmark model are normalized to 1

<table>
<thead>
<tr>
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<th>Age Group</th>
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<tr>
<td></td>
<td>25-34</td>
</tr>
<tr>
<td>Net worth</td>
<td>1.737</td>
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<td>TDA/net worth</td>
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<tr>
<td>TA/net worth</td>
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<td>Home equity/net worth</td>
<td>0.937</td>
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<tr>
<td>Home equity/home value</td>
<td>1.105</td>
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</table>
Conclusion

- Quantitative life-cycle model to study the interactions between housing and households’ use of TDA
- Model explains the cross-sectional variation in household net worth composition
  - TDA promotes home ownership and household debt
  - Home ownership rate and net worth composition adjust to TDA policies and housing-related factors
- Future work:
  1. household debt and housing price shocks
  2. TDA early withdrawal penalty