Can Property Taxes Reduce House Price Volatility? 
Evidence from U.S. Regions

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Bank of Lithuania Seminar
“Real Estate Taxation and Macroprudential Policy”
July 1-2, 2019

Disclaimer: The views presented in this paper are those of the author and do not represent the official position of the IMF or IMF policy.
Background

- The global crisis has shown that *curbing house price volatility* is important for enhancing macro-financial stability

- Main policy instruments
  - Monetary policy instruments
  - Macroprudential instruments

- Can fiscal policy also help?
  - Mortgage interest deductibility, transaction taxes, recurrent property taxes

- This paper focuses on *recurrent property taxes*
  - Empirical contribution: new dataset on recurrent property tax rates ($\tau$) in U.S. regions over 2005-14
Literature

- **Theory**
  - ✔ Van Den Noord (2005): simple model, house price fluctuations in response to a demand shock are greater when $\tau$ is low

- **Empirics**
  - ✔ Crowe et al. (2013): negative association between house price volatility and $\tau$ in a cross-section of U.S. metropolitan statistical areas
  - ✔ Aregger et al. (2010): transaction and capital gains taxes did not help reducing house price volatility in 21 Swiss cantons over 1985-2009

- Gyurko et al. (2008), Saiz (2010), Hilber and Vermeulen (2016): housing regulation and supply rigidities could lead to larger house price fluctuations
Van Den Noord’s theoretical framework (1)

- No arbitrage condition (Poterba, 1992; Poterba and Sinai, 2008)

\[ R_t(H) = P_t \cdot [i \cdot (1 - \theta) + \tau + \delta - \pi^e (1 - \mu)] \]

- Given the negative association between \( R \) and \( H \), this equation can be interpreted as a downward sloping demand for housing.
Van Den Noord’s theoretical framework (2)

- Housing supply function

\[ H_t = (1 - \delta) \cdot H_{t-1} + \varphi \left( \frac{P_t}{C_t} \right) \]

- \( \varphi \) = short-run price sensitivity of supply (small)
- \( \varphi/\delta \) = long-run price sensitivity of supply (could be large if \( \delta \) is small)
- \( C \) = construction costs

- If house price inflation is a linear function of observed price change in the previous period \( (P_t - P_{t-1} = a \cdot [P_{t-1} - P_{t-2}], \text{ with } a > 0) \) and \( \mu = 0 \), then

\[ P_t = \frac{a}{i \cdot (1 - \theta) + \tau + \delta \cdot (P_{t-1} - P_{t-2})} + \frac{R_t}{i \cdot (1 - \theta) + \tau + \delta} \]

- **Main takeaway**: after initial demand shock to \( R \), house prices will oscillate with a greater amplitude for lower values of property tax rate (\( \tau \))
Graphical illustration: Demand shock and house prices (1)

Panel I: More generous tax treatment of housing (low $\tau$)

Panel II: Less generous tax treatment of housing (high $\tau$)
Graphical illustration: Demand shock and house prices (2)

House prices

- Property tax = 1%
- Property tax = 2%
- Property tax = 3%

House price changes (%)

- Property tax = 1%
- Property tax = 2%
- Property tax = 3%
Data

○ U.S. regions: 51 states, 77 MSAs, 2005-14 period

○ House prices: Federal Housing Finance Agency
  ✓ Volatility: 5-year moving standard deviations of (i) house price growth rates, and (ii) percentage deviations of house prices from HP-filtered trends

○ Property taxes: American Community Survey (U.S. Census)
  ✓ Effective rate ($τ$): median annual tax property payment/median property value

○ Macro variables: Bureau of Economic Analysis (BEA)
  ✓ GDP (nominal, real, per capita), population, inflation

○ Housing supply restriction indices
  ✓ Geographical (Saiz, 2010)
  ✓ Regulatory (Gyourko et al., 2008)
House prices and property tax rates

Note: The sample includes 51 U.S. states over 2005-14. The line splitting the box indicates the median, the edges of the box indicate 25/75 percentiles, and the whiskers indicate minimum/maximum.
House price volatility: Two measures

Note: The sample includes 51 U.S. states over 2005-14. The line splitting the box indicates the median, the edges of the box indicate 25/75 percentiles, and the whiskers indicate minimum/maximum.
House price volatility and property tax rates

Note: The sample includes 51 U.S. states over 2005-14.
Empirical analysis

- Baseline specification

\[ VOL_{it} = \alpha + \beta \tau_{it} + \gamma'X_{it} + u_i + \omega_t + \varepsilon_{it} \]

- Effect of property tax rates on house price volatility (\( \beta \))
  - Association/correlation (FE OLS)
  - Causal effect (IV regressions, GMM)
Estimation results: Volatility of house price growth rate

<table>
<thead>
<tr>
<th>Property tax rate</th>
<th>-3.210***</th>
<th>-2.802***</th>
<th>-4.855***</th>
<th>-11.598***</th>
<th>-3.121***</th>
<th>-1.538***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[0.789]</td>
<td>[0.893]</td>
<td>[0.831]</td>
<td>[3.806]</td>
<td>[0.136]</td>
<td>[0.205]</td>
</tr>
<tr>
<td>Lagged dependent variable</td>
<td>0.497***</td>
<td>0.526***</td>
<td>0.518***</td>
<td>0.525***</td>
<td>0.697***</td>
<td>0.898***</td>
</tr>
<tr>
<td></td>
<td>[0.042]</td>
<td>[0.046]</td>
<td>[0.045]</td>
<td>[0.052]</td>
<td>[0.004]</td>
<td>[0.013]</td>
</tr>
<tr>
<td>Real GDP pc growth</td>
<td>-0.239***</td>
<td>-0.048</td>
<td>-0.238***</td>
<td>-0.075</td>
<td>-0.251***</td>
<td>-0.016***</td>
</tr>
<tr>
<td></td>
<td>[0.064]</td>
<td>[0.052]</td>
<td>[0.062]</td>
<td>[0.057]</td>
<td>[0.003]</td>
<td>[0.006]</td>
</tr>
<tr>
<td>Inflation (GDP deflator)</td>
<td>-0.067</td>
<td>0.023</td>
<td>-0.035</td>
<td>0.100***</td>
<td>-0.011</td>
<td>0.028***</td>
</tr>
<tr>
<td></td>
<td>[0.050]</td>
<td>[0.041]</td>
<td>[0.042]</td>
<td>[0.031]</td>
<td>[0.008]</td>
<td>[0.005]</td>
</tr>
<tr>
<td>Population growth</td>
<td>-0.165</td>
<td>-0.363*</td>
<td>-0.311</td>
<td>-0.42</td>
<td>0.233***</td>
<td>-0.072</td>
</tr>
<tr>
<td></td>
<td>[0.209]</td>
<td>[0.208]</td>
<td>[0.250]</td>
<td>[0.292]</td>
<td>[0.029]</td>
<td>[0.047]</td>
</tr>
<tr>
<td>Constant</td>
<td>6.792***</td>
<td>6.952***</td>
<td>8.489***</td>
<td>15.903***</td>
<td>5.235***</td>
<td>2.768***</td>
</tr>
<tr>
<td></td>
<td>[0.976]</td>
<td>[1.002]</td>
<td>[1.019]</td>
<td>[3.599]</td>
<td>[0.136]</td>
<td>[0.242]</td>
</tr>
</tbody>
</table>

| Economic significance | -1.54 | -1.34 | -2.33 | -5.52 | -1.50 | -0.73 |

Time FE | No | Yes | No | Yes | No | Yes

# observations | 459 | 459 | 441 | 441 | 459 | 459
# states | 51 | 51 | 49 | 49 | 51 | 51
R² | 0.43 | 0.60 | 0.43 | 0.47
F-stat from 1st stage | 15.51 | 8.23
Sargan test (p-value) | 1.00 | 1.00
AR(2) test (p-value) | 0.08 | 0.08

Note: FE OLS = panel OLS regressions with state fixed effects, IV=panel IV regressions with state fixed effects, with τ instrumented using average τ of neighboring states, GMM=system panel GMM with state fixed effects (Arellano-Bover).
Economic significance = response of house price volatility to a 1 standard deviation (0.48%) increase in τ.
Robust standard errors in brackets. *, **, and *** denote significance at the 10, 5, and 1 percent levels, respectively.
Estimation results: Volatility of detrended house prices

<table>
<thead>
<tr>
<th></th>
<th>Volatility (detrended house prices)</th>
<th>FE OLS</th>
<th>IV</th>
<th>GMM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property tax rate</td>
<td></td>
<td>-1.347** -1.177 -2.369*** -6.677** -2.136*** -1.162***</td>
<td>[0.626] [0.746] [0.700] [3.136] [0.087] [0.236]</td>
<td></td>
</tr>
<tr>
<td>Lagged dependent variable</td>
<td></td>
<td>0.465*** 0.474*** 0.462*** 0.469*** 0.731*** 0.798***</td>
<td>[0.035] [0.047] [0.033] [0.045] [0.003] [0.007]</td>
<td></td>
</tr>
<tr>
<td>Real GDP pc growth</td>
<td></td>
<td>-0.052 -0.038 -0.044 -0.063 -0.095*** -0.070***</td>
<td>[0.053] [0.057] [0.053] [0.058] [0.004] [0.010]</td>
<td></td>
</tr>
<tr>
<td>Inflation (GDP deflator)</td>
<td></td>
<td>-0.048 0.091* -0.075 0.151** -0.022*** 0.145***</td>
<td>[0.039] [0.049] [0.063] [0.063] [0.004] [0.009]</td>
<td></td>
</tr>
<tr>
<td>Population growth</td>
<td></td>
<td>-0.026 0.069 -0.143 0.08 0.057* 0.294***</td>
<td>[0.160] [0.120] [0.192] [0.194] [0.034] [0.082]</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>5.113*** 5.971*** 6.375*** 11.516*** 4.145*** 3.646***</td>
<td>[0.721] [0.800] [0.933] [3.134] [0.118] [0.391]</td>
<td></td>
</tr>
</tbody>
</table>

Economic significance
-0.64 -0.56 -1.13 -3.20 -1.02 -0.56

Time FE
- No Yes No Yes No Yes

# observations
459 459 441 441 459 459

# states
51 51 49 49 51 51

R^2
0.22 0.47 0.21 0.42

F-stat from 1st stage
12.14 8.85

Sargan test (p-value)
1.00 1.00

AR(2) test (p-value)
0.05 0.05

Note: FE OLS = panel OLS regressions with state fixed effects, IV=panel IV regressions with state fixed effects, with τ instrumented using average τ of neighboring states, GMM=system panel GMM with state fixed effects (Arellano-Bover).

Economic significance = response of house price volatility to a 1 standard deviation (0.48%) increase in τ.

Robust standard errors in brackets. *, **, and *** denote significance at the 10, 5, and 1 percent levels, respectively.
Difference-in-difference analysis

- Empirical specification (Rajan and Zingales, 1998)

\[
VOL_{mt} = \alpha + \beta \tau_{it} + \lambda (\tau_{it} \ast S_m) + \gamma'X_{it} + u_m + \omega_t + \varepsilon_{mt}
\]

i, m, t = state, MSA, and time

VOL = house price volatility

\(\tau\) = property tax rate

\(X\) = control variables

\(S\) = supply restriction indicators (geographical, regulatory)

\(u, \omega\) = unobserved state- and time-specific heterogeneity

- Difference-in-difference effect (\(\lambda\))

- H0: \(\lambda < 0\)

- Higher \(\tau\) at the state level would reduce house price volatility in MSAs with more rigid housing supply at a faster rate compared to MSAs with less rigid supply
Relationship between housing supply and regulatory restrictions indices

\[ y = 0.0093x - 0.1423 \]

\[ R^2 = 0.0824 \]

Source: Saiz (2010) and Gyourko et al. (2008).
### Estimation results: Difference-in-difference

<table>
<thead>
<tr>
<th></th>
<th>Volatility (house price growth)</th>
<th>Volatility (detrended house prices)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geographical</td>
<td>Regulatory</td>
</tr>
<tr>
<td>Property tax rate</td>
<td>-0.699</td>
<td>0.083</td>
</tr>
<tr>
<td></td>
<td>[1.148]</td>
<td>[1.479]</td>
</tr>
<tr>
<td>Property tax rate*Supply restrictions index</td>
<td>-0.076***</td>
<td>-0.068**</td>
</tr>
<tr>
<td></td>
<td>[0.027]</td>
<td>[0.029]</td>
</tr>
<tr>
<td>Lagged dependent variable</td>
<td>0.503***</td>
<td>0.549***</td>
</tr>
<tr>
<td></td>
<td>[0.048]</td>
<td>[0.030]</td>
</tr>
<tr>
<td>Real GDP per capita growth</td>
<td>-0.324**</td>
<td>-0.073</td>
</tr>
<tr>
<td></td>
<td>[0.120]</td>
<td>[0.102]</td>
</tr>
<tr>
<td>Inflation (GDP deflator growth)</td>
<td>-0.073</td>
<td>0.054</td>
</tr>
<tr>
<td></td>
<td>[0.067]</td>
<td>[0.048]</td>
</tr>
<tr>
<td>Population growth</td>
<td>-0.109</td>
<td>-0.380</td>
</tr>
<tr>
<td></td>
<td>[0.318]</td>
<td>[0.361]</td>
</tr>
<tr>
<td>Constant</td>
<td>6.299***</td>
<td>5.893***</td>
</tr>
<tr>
<td></td>
<td>[1.060]</td>
<td>[1.033]</td>
</tr>
</tbody>
</table>

Economic significance: -1.52 -1.30 -3.17 -2.99 -1.74 -1.96 -2.81 -2.88

Time FE
- No
- Yes

# observations
- 693
- 693
- 693
- 693
- 693
- 693
- 693
- 693

# MSAs / # states
- 77/29
- 77/29
- 77/29
- 77/29
- 77/29
- 77/29
- 77/29
- 77/29

R²
- 0.47
- 0.57
- 0.48
- 0.58
- 0.21
- 0.40
- 0.22
- 0.41

Note: Panel OLS with MSA fixed effects. Geographical supply restrictions index is taken from Saiz (2010), regulatory restrictions index is taken from Gyourko et al. (2008). Economic significance = response of house price volatility to a 25-75 interquartile increase in geographical restrictions index and τ. Robust standard errors in brackets. *, **, and *** denote significance at the 10, 5, and 1 percent levels, respectively.
Conclusions

- Property tax rates have a *negative impact* on house price volatility
  - 0.5% increase in average effective $\tau$ reduces house price volatility by 0.5-5.5%
  - The negative impact of property taxation is *causal* (IV, GMM regressions)
  - The results are *robust* to alternative measures of volatility

- *Policy implication*: property taxation could be used as an effective tool to reduce house price volatility and enhance macro-financial stability

- Caveats
  - U.S.-based results may not be representative for other countries
  - Short sample period may be influenced by the global crisis
The impact of higher $\tau$ on house price growth distribution

Original sample
(mean=0.93%, st. dev. = 7.6)

With higher property tax rate
(mean=0.93%, st. dev. = 4.6)
Thank you!