Employment Fluctuations, Real Estate Prices, and Property Taxes

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Motivation

- employment response $\rightarrow$ decline real estate prices

  residential

  Commercial Real Estate (CRE)

Motivation

- **employment response $\rightarrow$ decline real estate prices**
- $\downarrow$ real estate prices $\Longrightarrow$ employment demand
  - Housing Wealth Channel
  - Firm Collateral Channel

Motivation

- **employment response → decline real estate prices**
- ↓ real estate prices ⟹ employment demand
  - Housing Wealth Channel

residential prices → residential collateral → consumer demand → labor demand

Motivation

- **employment response $\rightarrow$ decline real estate prices**
- $\downarrow$ real estate prices $\Longrightarrow$ employment demand
  - Firm Collateral Channel

CRE prices $\rightarrow$ Coporate collateral $\rightarrow$ Corporate Borrowing $\rightarrow$ labor demand

Motivation

- $\downarrow$ real estate prices $\Longrightarrow$ employment demand
  - Housing Wealth Channel
  - Firm Collateral Channel
- drop residential + CRE prices $\Rightarrow$ decline in labor

Relative importance of Housing wealth & Firm collateral channel?

Motivation

- $\downarrow$ real estate prices $\Longrightarrow$ employment demand
  - Firm Collateral Channel
- drop residential + CRE prices $\Rightarrow$ decline in labor

Relative importance of Housing wealth & Firm collateral channel?

- Main issues
  i. separate both channels
  ii. tease out other mechanisms

This Paper

- **LITERATURE** $\Longrightarrow$ measuring each channel on employment

  Housing wealth

  - Mian and Sufi(2014), Guren et al.(2021)

  Firm collateral

  - Adelino et al.(2015), Giroud and Mueller (2017), and Bahaj et al. (2022)

This Paper

- **LITERATURE** $\Longrightarrow$ measuring each channel on employment

  Housing wealth

  - Mian and Sufi(2014), Guren et al.(2021)

  Firm collateral

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- Unified framework to measure both channels

  (1) **Reduced form evidence** $\Longrightarrow$ separate both channels

  (2) **Quantitative model** $\Longrightarrow$ tease out other mechanisms

This Paper

- Unified framework to measure both channels

  (1) **Reduced form evidence** $\Longrightarrow$ separate both channels

  ’12 Italian property tax reform + **DID** empirical design

  - estimate effect ↑ property taxes (**residential** vs **CRE**)

    (i) employment

    (ii) consumption expenditure

    (iii) residential prices

    (iv) CRE prices

This Paper

- Unified framework to measure both channels

  (2) **Quantitative model** $\Longrightarrow$ tease out other mechanisms

  houses & CRE pay diff. property taxes + financial frictions

This Paper

- Unified framework to measure both channels

  (2) **Quantitative model** $\implies$ tease out other mechanisms

  houses & CRE pay diff. property taxes + financial frictions

  $\implies$ **linear decomposition** of both channels

This Paper

- Unified framework to measure both channels

  (2) **Quantitative model** $\Longrightarrow$ tease out other mechanisms

  $\Longrightarrow$ **linear decomposition** of both channels

  housing wealth induced by $\uparrow$ residential taxes

This Paper

- Unified framework to measure both channels

  (2) **Quantitative model** $\Longrightarrow$ tease out other mechanisms

  $\Longrightarrow$ **linear decomposition** of both channels

  firm collateral induced by $\uparrow$ CRE taxes

This Paper

- Unified framework to measure both channels

  (1) **Reduced form evidence** $\implies$ separate both channels

  (2) **Quantitative model** $\implies$ tease out other mechanisms

  MAIN RESULT: both channels explain more than 80%

  $\downarrow$ employment drop after $\downarrow$ real estate prices

  $\implies$ induced by $\uparrow$ property taxes

Road Map

(1) MODEL

(2) MAIN DECOMPOSITION RESULTS

(3) EMPIRICAL STRATEGY & ESTIMATION RESULTS

(4) HOUSING WEALTH AND FIRM COLLATERAL CHANNEL ON EMPLOYMENT

(5) CONCLUSIONS & FUTURE WORK

Employment Fluctuations, Real Estate Prices, and Property Taxes

Quantitative Model

Model Setup

- closed economy, one period
- firms produce differentiated goods $\Longrightarrow j \in [0, 1]$
- two type of real estate properties
  - houses $H^h \Rightarrow$ households
  - CRE $H^f \Rightarrow$ firms
- real estate used as collateral
  - loans paid within period $\Rightarrow R = 0$
- dual property tax rate set by government
  - $\tau^h \Rightarrow$ Houses
  - $\tau^f \Rightarrow$ CRE

Households

- first stage
  - house purchase $\Rightarrow H^h$
  - non-housing expenditure $\Rightarrow C$
  - labor supply $\Rightarrow L$
- second stage
  - expenditure on varieties $\Rightarrow c_j$ for $j \in [0, 1]$

Households

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

Households

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad \underbrace{C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}}$$

separable preferences $\Rightarrow$ wealth effect $L^s \neq 0$

- **first stage** $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \underbrace{\frac{\chi}{1+\frac{1}{\nu}}}_{\text{Frisch elasticity} \Rightarrow \nu} L^{1+\frac{1}{\nu}}$$

- first stage $\Rightarrow H^h$, C, and L

$$\max_{\{C,L,H^h\}} \underbrace{C^{\beta}(H^h)^{1-\beta}}_{\substack{\text{Cobb Douglass} \\ \text{aggregator}}\Rightarrow \beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

Households

- **first stage** $\Rightarrow H^h$, C, and L

$$\max_{\{C,L,H^h\}} \quad C^\beta (H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$
$$\text{subject to} \quad C + P^h H^h \left(1+\tau^h\right) = WL + \Pi$$

- **first stage** $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad \underbrace{C}_{P_c = 1} + P^h H^h \left(1+\tau^h\right) = WL + \Pi$$

Households

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^\beta (H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + \underbrace{P^h H^h \left(1+\tau^h\right)}_{} = WL + \Pi$$

residential property taxes $\propto$ housing wealth

Households

- first stage $\Rightarrow H^h$, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + P^h H^h \left(1+\tau^h\right) = \underbrace{W L}_{\text{labor income}} + \Pi$$

Households

- first stage $\Rightarrow H^h$, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + P^h H^h \left(1+\tau^h\right) = W L + \underbrace{\Pi}_{\text{profits}}$$

Households

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + P^h H^h \left(1 + \tau^h\right) = W L + \Pi$$

$$\underbrace{C \leq \phi_h \, P^h H^h}_{\text{borrowing constraint}}$$

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + P^h H^h \left(1+\tau^h\right) = W L + \Pi$$

$$\underbrace{C \leq \phi_h P^h H^h}_{\text{HH's collateral requirement} \;\Rightarrow\; \phi_h}$$

Households

- first stage $\Rightarrow$ H^h, C, and L

$$\max_{\{C,L,H^h\}} \quad C^{\beta}(H^h)^{1-\beta} - \frac{\chi}{1+\frac{1}{\nu}} L^{1+\frac{1}{\nu}}$$

$$\text{subject to} \quad C + P^h H^h \left(1+\tau^h\right) = W L + \Pi$$

$$C \leq \phi_h \, P^h H^h$$

foc's solution

Households

- **second stage** $\Rightarrow c_j$ for $j \in [0,1]$

$$\min_{(c_j)_{j\in[0,1]}} \int_0^1 p_j c_j dj$$

- **second stage** $\Rightarrow$ c_j for $j \in [0,1]$

$$\min_{(c_j)_{j\in[0,1]}} \quad \int_0^1 p_j c_j dj$$

$$\text{subject to} \quad C \geq \underbrace{\left(\int_0^1 c_j^{1-\frac{1}{\epsilon}} \, dj \right)^{\frac{1}{1-\frac{1}{\epsilon}}}}_{\text{CES aggregator}}$$

- **second stage** $\Rightarrow$ c_j for $j \in [0,1]$

$$\min_{(c_j)_{j\in[0,1]}} \int_0^1 p_j c_j dj$$

subject to

$$C \geq \underbrace{\left(\int_0^1 c_j^{1-\frac{1}{\epsilon}} dj \right)^{\frac{1}{1-\frac{1}{\epsilon}}}}_{j\text{'s elasticity of demand} \quad \Rightarrow \quad \epsilon}$$

$$p_j = \left(\frac{C}{c_j} \right)^{\frac{1}{\epsilon}}$$

Households

- **second stage** $\Rightarrow c_j$ for $j \in [0,1]$

$$\min_{(c_j)_{j\in[0,1]}} \quad \int_0^1 p_j c_j dj$$

$$\text{subject to} \quad C \geq \left(\int_0^1 c_j^{1-\frac{1}{\epsilon}} \, dj \right)^{\frac{1}{1-\frac{1}{\epsilon}}}$$

Firm producing variety j

- profit maximization
  - invest in Commercial Real Estate (**CRE**) $\Rightarrow H_j^f$
  - hire labor $\Rightarrow L_j$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

Firm producing variety j

- **profit maximization** $\Rightarrow$ H_j^f and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \underbrace{p_j \, c_j(L_j, H_j^f)}_{\text{operating revenues}} - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \underbrace{p_j \, c_j(L_j, H_j^f)}_{\text{CRE technology} \Rightarrow c_j = L_j^{\alpha} (H_j^f)^{1-\alpha}} - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} p_j \; c_j(L_j, H_j^f) - \underbrace{W L_j}_{\text{labor costs}} - P^f H_j^f \left(1 + \tau^f\right)$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} p_j \, c_j(L_j, H_j^f) - W L_j - \underbrace{P^f H_j^f}_{\text{CRE investment}} \left(1 + \tau^f\right)$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j\, c_j(L_j, H_j^f) - W L_j - \underbrace{P^f H_j^f \left(1 + \boldsymbol{\tau}^f\right)}_{\substack{\text{CRE} \qquad\quad \text{tangible} \\ \text{taxes} \;\propto\; \text{fixed assets}}}$$

Firm producing variety j

- **profit maximization** $\Rightarrow$ H_j^f and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad \underbrace{p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}}_{\text{inverse demand}}$$

Firm producing variety j

- **profit maximization** $\Rightarrow$ H_j^f and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}$$

$$\underbrace{W L_j \leq \phi_f \, P^f H_j^f}_{\text{collateral constraint}}$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j\, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}$$

$$\underbrace{W L_j}_{\text{working capital}} \leq \phi_f\, P^f H_j^f$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}$$

$$W L_j \leq \phi_f \underbrace{P^f H_j^f}_{\text{collateral value}}$$

FIRM PRODUCING VARIETY j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}$$

$$\underbrace{W L_j \leq \phi_f \, P^f H_j^f}_{\text{firm's coll. requirement}} \Rightarrow \phi_f$$

Firm producing variety j

- **profit maximization** $\Rightarrow H_j^f$ and L_j

$$\Pi_j = \max_{\{L_j, H_j^f\}} \quad p_j \, c_j(L_j, H_j^f) - W L_j - P^f H_j^f \left(1 + \tau^f\right)$$

$$\text{subject to} \quad p_j = \left[\frac{C}{c\left(L_j, H_j^f\right)}\right]^{\frac{1}{\epsilon}}$$

$$W L_j \leq \phi_f \, P^f H_j^f$$

FOC's Solution

Supply Real Estate Assets

- construction sector represented by supply functions

$$H^h(P^h) = (P^h)^{\sigma_h}$$

$$H^f(P^f) = (P^f)^{\sigma_f}$$

supply price-elasticity $\begin{cases} \sigma_h \rightarrow \text{Residential properties} \\ \sigma_f \rightarrow \text{CRE properties} \end{cases}$

Employment Fluctuations, Real Estate Prices, and Property Taxes

Decomposing both Channels: Property Tax Increase

Competitive Equilibrium and Effect of a Property Tax Increase

- model's constrained equilibrium

$$\Rightarrow \Theta = \left[\beta, \nu, \alpha, \epsilon, \phi_h, \phi_f, \sigma_h, \sigma_f\right]$$

$$\textbf{allocations} \rightarrow \quad L\left(\Theta, \tau^h, \tau^f\right) \quad C\left(\Theta, \tau^h, \tau^f\right)$$

$$\textbf{prices} \rightarrow \quad P^h\left(\Theta, \tau^h, \tau^f\right) \quad P^f\left(\Theta, \tau^h, \tau^f\right)$$

equilibrium definition | binding borrowing constraints | log-lin solution

Competitive Equilibrium and Effect of a Property Tax Increase

- model's constrained equilibrium

$$\Rightarrow \Theta = \left[\beta, \nu, \alpha, \epsilon, \phi_h, \phi_f, \sigma_h, \sigma_f\right]$$

$$\left.\begin{array}{rcl} \textbf{allocations} & \rightarrow & L\left(\Theta, \tau^h, \tau^f\right) \quad C\left(\Theta, \tau^h, \tau^f\right) \\ \textbf{prices} & \rightarrow & P^h\left(\Theta, \tau^h, \tau^f\right) \quad P^f\left(\Theta, \tau^h, \tau^f\right) \end{array}\right\} \begin{array}{l} \text{closed-form solution} \\ \approx \text{log-linear in } \tau^h \ \& \ \tau^f \end{array}$$

equilibrium definition | binding borrowing constraints | log-lin solution

Competitive Equilibrium and Effect of a Property Tax Increase

- model's constrained equilibrium

$\Rightarrow \Theta = \left[\beta, \nu, \alpha, \epsilon, \phi_h, \phi_f, \sigma_h, \sigma_f\right]$

$$\left.\begin{array}{rcl} \textbf{allocations} & \rightarrow & L\left(\Theta, \tau^h, \tau^f\right) \quad C\left(\Theta, \tau^h, \tau^f\right) \\ \textbf{prices} & \rightarrow & P^h\left(\Theta, \tau^h, \tau^f\right) \quad P^f\left(\Theta, \tau^h, \tau^f\right) \end{array}\right\} \begin{array}{l} \text{closed-form solution} \\ \approx \text{log-linear in } \tau^h \;\&\; \tau^f \end{array}$$

- effect of an increase in property taxes

equilibrium definition | binding borrowing constraints | log-lin solution

- model's constrained equilibrium

$\Rightarrow \Theta = [\beta, \nu, \alpha, \epsilon, \phi_h, \phi_f, \sigma_h, \sigma_f]$

$$\left.\begin{array}{rl} \textbf{allocations} \rightarrow & L\left(\Theta, \tau^h, \tau^f\right) \quad C\left(\Theta, \tau^h, \tau^f\right) \\ \textbf{prices} \rightarrow & P^h\left(\Theta, \tau^h, \tau^f\right) \quad P^f\left(\Theta, \tau^h, \tau^f\right) \end{array}\right\}$$

closed-form solution

$\approx$ log-linear in τ^h & τ^f

- effect of an increase in property taxes

$\Longrightarrow$ compare equilibrium for high/low tax regimes

equilibrium definition | binding borrowing constraints | log-lin solution

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \;\&\; (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

equilibrium definition | binding borrowing constraints | log-lin solution

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \ \& \ (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

- **equilibrium** $Y = \left\{L, C, P^h, P^f\right\} \Longrightarrow$ log-lin

$$\begin{cases} Y_1(\Theta, \tau_1^h, \tau_1^f) \\ Y_0(\Theta, \tau_0^h, \tau_0^f) \end{cases} \Longrightarrow y = \log(Y_1) - \log(Y_0)$$

equilibrium definition | binding borrowing constraints | log-lin solution

Competitive Equilibrium and Effect of a Property Tax Increase

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \ \& \ (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

- **equilibrium** employment $L \Longrightarrow$ log-lin

$$\begin{cases} L_1(\Theta, \tau_1^h, \tau_1^f) \\ L_0(\Theta, \tau_0^h, \tau_0^f) \end{cases} \Longrightarrow l = \log(L_1) - \log(L_0)$$

Competitive Equilibrium and Effect of a Property Tax Increase

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \;\&\; (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

- **equilibrium** employment L is log-lin $\Longrightarrow$ $\log(L_1) - \log(L_0)$

$$l \;=\; \beta_{l,h}(\Theta)\,\Delta\tau^h \;+\; \beta_{l,f}(\Theta)\,\Delta\tau^f$$

$$\Delta\tau^i = \tau_1^i - \tau_0^f$$

equilibrium definition | binding borrowing constraints | log-lin solution | equilib. response | coeff.$\Delta\tau_h$ | coeff. $\Delta\tau_f$

Competitive Equilibrium and Effect of a Property Tax Increase

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \ \& \ (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

- **equilibrium** employment L is log-lin $\Longrightarrow$

$$l = \beta_{l,h}(\boldsymbol{\Theta}) \ \Delta\tau^h + \beta_{l,f}(\boldsymbol{\Theta}) \ \Delta\tau^f$$

model's reduced form effect $\Longrightarrow$

$$\begin{cases} \beta_{l,h}(\boldsymbol{\Theta}) = \dfrac{\partial l}{\partial \boldsymbol{\Delta\tau_h}} \\ \beta_{l,f}(\boldsymbol{\Theta}) = \dfrac{\partial l}{\partial \boldsymbol{\Delta\tau_f}} \end{cases}$$

equilibrium definition | binding borrowing constraints | log-lin solution | equilib. response | coeff.$\Delta\tau_h$ | coeff. $\Delta\tau_f$

Competitive Equilibrium and Effect of a Property Tax Increase

- high/low tax regimes

$$(\tau_1^h, \tau_1^f) \;\&\; (\tau_0^h, \tau_0^f) \Longrightarrow \tau_1^i > \tau_0^i, \quad i = \{h, f\}$$

- **complete equilibrium** $\Longrightarrow Y = \left\{L, C, P^h, P^f\right\}$

$$\begin{aligned} l &= \beta_{l,h}(\Theta)\,\Delta\tau^h + \beta_{l,f}(\Theta)\,\Delta\tau^f \\ c &= \beta_{c,h}(\Theta)\,\Delta\tau^h + \beta_{c,f}(\Theta)\,\Delta\tau^f \\ p^h &= \beta_{p^h,h}(\Theta)\,\Delta\tau^h + \beta_{p^h,f}(\Theta)\,\Delta\tau^f \\ p^f &= \beta_{p^f,h}(\Theta)\,\Delta\tau^h + \beta_{p^f,f}(\Theta)\,\Delta\tau^f \end{aligned}$$

equilibrium definition | binding borrowing constraints | log-lin solution | equilib. response | coeff.$\Delta\tau_h$ | coeff. $\Delta\tau_f$

Firm Collateral Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$ & $\Delta\tau^h = 0$

$$l \;=\; \beta_{l,f}(\Theta)\;\Delta\tau^f$$

Firm Collateral Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$

$$l \;=\; \beta_{l,f}(\Theta)\;\Delta\tau^f$$

- $\beta_{l,f}(\Theta)$ capture firm collateral channel

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta_f^w(\Theta) + \delta_f^{p^h}(\Theta)$$

Firm Collateral Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$

$$\beta_{l,f}(\Theta) = \underbrace{\delta^{\text{coll}}(\Theta)}_{\text{firm collateral channel}} + \delta_f^w(\Theta) + \delta_f^{p^h}(\Theta)$$

for $\boldsymbol{w = p^h = 0}$

$$\delta^{\text{coll}} = \frac{\partial l^d}{\partial p^f}\frac{\partial p^f}{\partial \Delta\tau^f}$$

Firm Collateral: Intuition

Firm Collateral Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \underbrace{\delta_f^{w}(\Theta) + \delta_f^{p^h}(\Theta)}_{\substack{\text{GE} \\ \text{adjustment}}}$$

GE adjustment $\Longrightarrow$ response $\{P^h, W\}$ to $\Delta\tau^f > 0$

GE Adjustment: Intuition

Firm Collateral Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta_f^{w}(\Theta) + \delta_f^{p^h}(\Theta)$$

- closed form expression for $\delta^{\text{coll}}(\Theta)$

$$\delta^{\text{coll}}(\Theta) = -\left(\frac{\epsilon}{1+\phi_f}\right)\left(\frac{1+\boldsymbol{\sigma}_f}{1+\boldsymbol{\sigma}_f+(1-\alpha)(\epsilon-1)}\right)$$

- defined by $\Longrightarrow \boldsymbol{\sigma}_f$ and ϕ_f

Housing Wealth Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^h > 0$ & $\Delta\tau^f = 0$

$$l \;=\; \beta_{l,h}(\Theta)\,\Delta\tau^h$$

Housing Wealth Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^f > 0$

$$l = \beta_{l,h}(\Theta)\,\Delta\tau^h$$

- $\beta_{l,h}(\Theta)$ capture housing wealth channel

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta_h^w(\Theta) + \delta_h^{p^f}(\Theta)$$

Housing Wealth Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^h > 0$

$$\beta_{l,h}(\Theta) = \underbrace{\delta^{\text{wealth}}(\Theta)}_{\text{housing wealth channel}} + \delta_h^w(\Theta) + \delta_h^{p^f}(\Theta)$$

for $w = p^f = 0$

$$\delta^{\text{wealth}} = \frac{\partial l}{\partial \Delta\tau^h} = \frac{\partial l^d}{\partial c}\frac{\partial c}{\partial p^h}\frac{\partial p^h}{\partial \Delta\tau^h}$$

Housing Wealth Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^h > 0$

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \underbrace{\delta_h^w(\Theta) + \delta_h^{p^f}(\Theta)}_{\text{GE adjustment}}$$

GE adjustment $\Longrightarrow$ response $\{P^f, W\}$ to $\Delta\tau^h > 0$

Housing Wealth Channel on Employment

- equilibrium response for employment $\Longrightarrow \Delta\tau^h > 0$

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta_h^{w}(\Theta) + \delta_h^{p^f}(\Theta)$$

- closed form expression for $\delta^{\text{wealth}}(\Theta)$

$$\delta^{\text{wealth}}(\Theta) = -\left(\frac{1+\nu}{1+\phi_h}\right)\left(\frac{1+\boldsymbol{\sigma}_h}{1+\boldsymbol{\sigma}_h+(1-\beta)\nu}\right)$$

- depends $\Longrightarrow \boldsymbol{\sigma}_h$ and ϕ_h

- equilibrium response for employment

$$l \;=\; \beta_{l,h}(\Theta)\, \Delta\tau^{h} \;+\; \beta_{l,f}(\Theta)\, \Delta\tau^{f}$$

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta_h^{w}(\Theta) + \delta_h^{p^f}(\Theta)$$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta_f^{w}(\Theta) + \delta_f^{p^h}(\Theta)$$

Next Step

- equilibrium response for employment

$$l \;=\; \beta_{l,h}(\Theta)\,\Delta\tau^{h} \;+\; \beta_{l,f}(\Theta)\,\Delta\tau^{f}$$

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta^{w}_{h}(\Theta) + \delta^{p^f}_{h}(\Theta)$$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta^{w}_{f}(\Theta) + \delta^{p^h}_{f}(\Theta)$$

- discipline the model $[\sigma_h, \phi_h, \sigma_f, \phi_f] \Longrightarrow$ empirical estimates $\left\{\hat{\beta}_{y,h}, \hat{\beta}_{y,f}\right\}$
  - employment
  - consumption expenditure
  - Residential and CRE prices

Next Step

- equilibrium response for employment

$$l = \beta_{l,h}(\Theta)\,\Delta\tau^{h} + \beta_{l,f}(\Theta)\,\Delta\tau^{f}$$

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta_h^{w}(\Theta) + \delta_h^{p^f}(\Theta)$$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta_f^{w}(\Theta) + \delta_f^{p^h}(\Theta)$$

- empirical estimates $\left\{\hat{\beta}_{y,h}, \hat{\beta}_{y,f}\right\}$
  - employment
  - consumption expenditure
  - Residential and CRE prices
- Empirical analysis $\Longrightarrow$ '12 Italian property tax reform + DID

Employment Fluctuations, Real Estate Prices, and Property Taxes

Empirical Analysis: The Italian Tax Reform

Why the Italian economy?

(1) Dual tax rate $\Longrightarrow$ house-owners **vs** CRE-owners

(2) Property taxes defined independently by municipalities each year

(3) ’12 Property Tax Reform $\Longrightarrow$ force municipalities $\uparrow$ property taxes

Why the Italian economy?

(1) Dual tax rate $\Longrightarrow$ house-owners **vs** CRE-owners

- ***principal*** $\Longrightarrow \tau^{h}$

  house-owners $\Rightarrow$ if used as main residence

- ***secondary*** $\Longrightarrow \tau^{f}$

  other properties $\Rightarrow$ firms that own CRE

Why the Italian economy?

(1) Dual tax rate $\implies$ house-owners **vs** CRE-owners

(2) Property taxes defined independently by municipalities each year

$\implies \uparrow$ or $\downarrow$ $\{\tau^h, \tau^f\} \in [\overline{\tau}, \underline{\tau}]$

Why the Italian economy?

(1) Dual tax rate $\Longrightarrow$ house-owners **vs** CRE-owners

(2) Property taxes defined independently by municipalities each year

(3) '12 Property Tax Reform $\Longrightarrow$ force municipalities $\uparrow$ property taxes

- higher τ^h & τ^f Details
- variation across municipalities Details

Employment Fluctuations, Real Estate Prices, and Property Taxes

Empirical Analysis: Data

Data

- Municipal level data
  - Balance panel
  - 6,220 municipalities
  - Period 2008-2014

representativeness | stat: main var | stat: add var | non-trad employment | consumption | real estate prices

DATA

- Variables of interest

    1. Property tax rate (τ^h, τ^f)
    2. Employment (L)
    3. Consumption Expenditure (C)
    4. Real Estate Prices (P^h, P^f)

representativeness | stat: main var | stat: add var | non-trad employment | consumption | real estate prices

- Variables of interest
  1. Property tax rate (τ^h, τ^f)
     - From official acts issued each year by municipalities
  2. Employment (L)
  3. Consumption Expenditure (C)
  4. Real Estate Prices (P^h, P^f)

Data

- Variables of interest

1. Property tax rate (τ^h, τ^f)
2. Employment (L)
   - yearly census on establishments
   - employees working in establishments located in municipality
   - focus $\implies$ Non-Tradable sector
   - exclude $\implies$ Construction sector
3. Consumption Expenditure (C)
4. Real Estate Prices (P^h, P^f)

representativeness | stat: main var | stat: add var | non-trad employment | consumption | real estate prices

Data

- Variables of interest

  1. Property tax rate (τ^h, τ^f)
  2. Employment (L)
  3. Consumption Expenditure (C)
     - proxy $\Longrightarrow$ new vehicles household expenditure
  4. Real Estate Prices (P^h, P^f)

representativeness | stat: main var | stat: add var | non-trad employment | consumption | real estate prices

DATA

- Variables of interest

  1. Property tax rate (τ^h, τ^f)
  2. Employment (L)
  3. Consumption Expenditure (C)
  4. Real Estate Prices (P^h, P^f)
     - Houses $\Rightarrow$ residential properties
     - Commercial real estate $\Rightarrow$ retail stores properties

representativeness | stat: main var | stat: add var | non-trad employment | consumption | real estate prices

Employment Fluctuations, Real Estate Prices, and Property Taxes

Empirical Analysis: Estimation Strategy

Specification: Two-way Fixed Effect Model

- **NOTATION**: $m, t =$ municipality, year
  - $Y_{m,t}$: outcome variable $\Rightarrow Y = \left\{L, C, P^h, P^f\right\}$
  - $y_{m,t} = \frac{Y_{m,t} - Y_{m,t-1}}{(Y_{m,t} + Y_{m,t-1})/2} \Rightarrow y = \left\{l, c, p^h, p^f\right\}$
  - $\Delta\tau^i_{m,t} = \tau^i_{m,t} - \tau^i_{m,t-1}$ for $i = \{h, f\}$
    - ⋆ Principal tax rate: τ^h
    - ⋆ Secondary tax rate: τ^f

Specification: Two-way Fixed Effect Model

- Baseline specification $\Rightarrow$ DID

$$y_{m,t} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\, \Delta\tau^h_{m,t} \times 1\{t = 2012\} + \beta_{y,f}\, \Delta\tau^f_{m,t} \times 1\{t = 2012\} + \epsilon_{m,t}$$

  - FE_m: Municipality FE
  - FE_t: Year FE
  - $\epsilon_{m,t} \Longrightarrow$ unobserved trend components

    Covariance matrix $\epsilon_{m,t}$

    $\Longrightarrow$ clustered across municipalities within same local labor market

Specification: Two-way Fixed Effect Model

- Baseline specification ⇒ DID

$$y_{m,t} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\, \Delta\tau^h_{m,t} \times 1\{t = 2012\} + \beta_{y,f}\, \Delta\tau^f_{m,t} \times 1\{t = 2012\} + \epsilon_{m,t}$$

- coefficients of interest ⇒ $\beta_{y,h}$ & $\beta_{y,f}$
  - $\Delta\tau^i_{m,t} \times 1\{t = 2012\}$ = treatment intensity × post-tax reform
- Interpreting $\beta_{y,i}$
  - 1 pp. $\Delta\tau^i$ higher $\Longrightarrow$ change y by $\beta_{y,i}$ pp.

Employment Fluctuations, Real Estate Prices, and Property Taxes

Empirical Analysis: Results

Baseline Results

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$				
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$				
N_{mun}				
R^2				

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results

- $\uparrow \tau^h, \tau^f \implies \downarrow l^{nt}$

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***			
	(0.015)			
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***			
	(0.011)			
N_{mun}	6.220			
R^2	0.13			

$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results

- $\uparrow \tau^h \implies \downarrow c$

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***	-0.517***		
	(0.015)	(0.145)		
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***	-0.177		
	(0.011)	(0.120)		
N_{mun}	6.220	6.104		
R^2	0.13	0.12		

$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results

- $\uparrow \tau^h, \tau^f \Longrightarrow \downarrow p^h$

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***	-0.517***	-0.022**	
	(0.015)	(0.145)	(0.009)	
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***	-0.177	-0.017***	
	(0.011)	(0.120)	(0.006)	
N_{mun}	6.220	6.104	5.534	
R^2	0.13	0.12	0.33	

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results

- $\uparrow \tau^f \implies \downarrow p^f$

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***	-0.517***	-0.022**	-0.005
	(0.015)	(0.145)	(0.009)	(0.010)
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***	-0.177	-0.017***	-0.032***
	(0.011)	(0.120)	(0.006)	(0.008)
N_{mun}	6.220	6.104	5.534	3.687
R^2	0.13	0.12	0.33	0.31

$^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***	-0.517***	-0.022**	-0.005
	(0.015)	(0.145)	(0.009)	(0.010)
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***	-0.177	-0.017***	-0.032***
	(0.011)	(0.120)	(0.006)	(0.008)
N_{mun}	6.220	6.104	5.534	3.687
R^2	0.13	0.12	0.33	0.31

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

stat: main var | stat: add var | more results

Baseline Results

- **baseline results**

$\Longrightarrow$ credible identification

$\Longrightarrow$ robust

Baseline Results

- baseline results

$\Longrightarrow$ credible identification

– systematic pre-tax reform trend differences

$\Longrightarrow$ event study approach implementation

$\Delta\tau^h$ results

$\Delta\tau^f$ results

Baseline Results

- baseline results

$\Longrightarrow$ credible identification

- balancing across municipalities with different treatment intensities implementation
  - eco & fin conditions results
  - migration patterns employment shares results
  - local governments finances results

Baseline Results

- baseline results

$\Longrightarrow$ robust results

  - adding regressors implementation

Baseline Results

- baseline results

$\Longrightarrow$ robust results

- spillover effects implementation

Baseline Results

- baseline results

$\Longrightarrow$ robust results

  - alternative hypothesis

    (i) uncertainty implementation

    (ii) productivity implementation

    (iii) credit supply implementation

Baseline Results

- baseline results

$\Longrightarrow$ credible identification

$\Longrightarrow$ robust

Employment Fluctuations, Real Estate Prices, and Property Taxes

Calibration

- recall $\Longrightarrow$ **main decomposition result**

$$\beta_{l,h}(\Theta) = \delta^{\text{wealth}}(\Theta) + \delta_h^{w}(\Theta) + \delta_h^{p^f}(\Theta)$$

$$\beta_{l,f}(\Theta) = \delta^{\text{coll}}(\Theta) + \delta_f^{w}(\Theta) + \delta_f^{p^h}(\Theta)$$

$$\delta^{\text{wealth}}(\Theta) = -\left(\frac{1+\nu}{1+\phi_h}\right)\left(\frac{1+\sigma_h}{1+\sigma_h+(1-\beta)\nu}\right)$$

$$\delta^{\text{coll}}(\Theta) = -\left(\frac{\epsilon}{1+\phi_f}\right)\left(\frac{1+\sigma_f}{1+\sigma_f+(1-\alpha)(\epsilon-1)}\right)$$

Calibration Procedure

- defined externally $\Longrightarrow \Theta_{\text{out}} = [\boldsymbol{\alpha}, \boldsymbol{\epsilon}, \boldsymbol{\nu}, \boldsymbol{\beta}]$

$$\delta^{\text{wealth}}(\Theta) = -\left(\frac{1+\boldsymbol{\nu}}{1+\phi_h}\right)\left(\frac{1+\sigma_h}{1+\sigma_h+(1-\boldsymbol{\beta})\boldsymbol{\nu}}\right)$$

$$\delta^{\text{coll}}(\Theta) = -\left(\frac{\boldsymbol{\epsilon}}{1+\phi_f}\right)\left(\frac{1+\sigma_f}{1+\sigma_f+(1-\boldsymbol{\alpha})(\boldsymbol{\epsilon}-1)}\right)$$

- defined externally $\Longrightarrow \Theta_{\text{out}} = [\alpha\,, \epsilon\,, \nu\,, \beta]$

	Parameter	Value	Target
Labor Share	α	0.6	Common in literature
Frisch elasticity	ν	1	Common in literature
Elasticity of demand	ϵ	4	Common in literature
Exp. share goods	β	0.8	Berger et al.(2018)

Calibration Procedure

- internal calibration $\Longrightarrow \Theta_{\text{in}} = \left[\boldsymbol{\sigma}_h, \boldsymbol{\sigma}_f, \phi_h, \phi_f\right]$

$$\delta^{\text{wealth}}(\Theta) = -\left(\frac{1+\nu}{1+\phi_h}\right)\left(\frac{1+\boldsymbol{\sigma}_h}{1+\boldsymbol{\sigma}_h+(1-\beta)\nu}\right)$$

$$\delta^{\text{coll}}(\Theta) = -\left(\frac{\epsilon}{1+\phi_f}\right)\left(\frac{1+\boldsymbol{\sigma}_f}{1+\boldsymbol{\sigma}_f+(1-\alpha)(\epsilon-1)}\right)$$

- calibrate $\Theta_{in} = [\sigma_h , \sigma_f , \phi_h , \phi_f] \Longrightarrow \{\hat{\beta}_{y,h} , \hat{\beta}_{y,f}\}$

$$\underbrace{\begin{bmatrix} \hat{\beta}_{l,h} & \hat{\beta}_{l,f} \\ \hat{\beta}_{c,h} & \hat{\beta}_{c,f} \\ \hat{\beta}_{p^h,h} & \hat{\beta}_{p^h,f} \\ \hat{\beta}_{p^f,h} & \hat{\beta}_{p^f,f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} \beta_{l,h}(\Theta) & \beta_{l,f}(\Theta) \\ \beta_{c,h}(\Theta) & \beta_{c,f}(\Theta) \\ \beta_{p^h,h}(\Theta) & \beta_{p^h,f}(\Theta) \\ \beta_{p^f,h}(\Theta) & \beta_{p^f,f}(\Theta) \end{bmatrix}}_{\text{MODEL}}$$

- Won't target $\hat{\beta}_{l,h}$, $\hat{\beta}_{l,f} \Longrightarrow$ Model validation test

  Compare $\beta_{l,h}(\Theta)$, $\beta_{l,f}(\Theta)$ to $\hat{\beta}_{l,h}$, $\hat{\beta}_{l,f}$

$$\underbrace{\begin{bmatrix} \hat{\beta}_{l,h} & \hat{\beta}_{l,f} \\ \hat{\beta}_{c,h} & \hat{\beta}_{c,f} \\ \hat{\beta}_{p^h,h} & \hat{\beta}_{p^h,f} \\ \hat{\beta}_{p^f,h} & \hat{\beta}_{p^f,f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} \beta_{l,h}(\Theta) & \beta_{l,f}(\Theta) \\ \beta_{c,h}(\Theta) & \beta_{c,f}(\Theta) \\ \beta_{p^h,h}(\Theta) & \beta_{p^h,f}(\Theta) \\ \beta_{p^f,h}(\Theta) & \beta_{p^f,f}(\Theta) \end{bmatrix}}_{\text{MODEL}}$$

Calibration Procedure

- Exclude $\hat{\beta}_{c,f}$, $\hat{\beta}_{p^f,h}$ $\Longrightarrow$ Non-statistically significant

$$\underbrace{\begin{bmatrix} \hat{\beta}_{c,h} & \hat{\beta}_{c,f} \\ \hat{\beta}_{p^h,h} & \hat{\beta}_{p^h,f} \\ \hat{\beta}_{p^f,h} & \hat{\beta}_{p^f,f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} \beta_{c,h}(\Theta) & \beta_{c,f}(\Theta) \\ \beta_{p^h,h}(\Theta) & \beta_{p^h,f}(\Theta) \\ \beta_{p^f,h}(\Theta) & \beta_{p^f,f}(\Theta) \end{bmatrix}}_{\text{MODEL}}$$

Baseline Results

Calibration Procedure

- Target moments

$$\Longrightarrow \hat{\beta}_{c,h},\ \hat{\beta}_{p^h,h},\ \hat{\beta}_{p^h,f},\ \hat{\beta}_{p^f,f}$$

$$\underbrace{\begin{bmatrix} \hat{\beta}_{c,h} & \hat{\beta}_{c,f} \\ \hat{\beta}_{p^h,h} & \hat{\beta}_{p^h,f} \\ \hat{\beta}_{p^f,h} & \hat{\beta}_{p^f,f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} \beta_{c,h}(\Theta_{out},\phi_h) & \beta_{c,f}(\Theta) \\ \beta_{p^h,h}(\Theta_{out},\sigma_h) & \beta_{p^h,f}(\Theta_{out},\phi_f) \\ \beta_{p^f,h}(\Theta) & \beta_{p^f,f}(\Theta_{out},\sigma_f) \end{bmatrix}}_{\text{MODEL}}$$

$$\phi_h \rightarrow \beta_{c,h}(\Theta) = \hat{\beta}_{c,h} \text{ and } \phi_f \rightarrow \beta_{p^h,f}(\Theta) = \hat{\beta}_{p^h,f}$$

$$\sigma_h \rightarrow \beta_{p^h,h}(\Theta) = \hat{\beta}_{p^h,h} \text{ and } \sigma_f \rightarrow \beta_{p^f,f}(\Theta) = \hat{\beta}_{p^f,f}$$

Baseline Results

CALIBRATION PROCEDURE

calibrate $\Theta_{in} = \left[\sigma_h\,, \sigma_f\,, \phi_h\,, \phi_f\right] \Longrightarrow \left\{\hat{\beta}_{y,h}\,,\ \hat{\beta}_{y,f}\right\}$

	Parameter	Value	Target
Supply elast. houses	σ_h	4.87	$\hat{\beta}_{P^h,h}$
Supply elast. CRE	σ_f	2.40	$\hat{\beta}_{P^f,f}$
LTV HH's	ϕ_h	0.23	$\hat{\beta}_{C,h}$
LTV firms	ϕ_f	0.35	$\hat{\beta}_{P^h,f}$

- calibration is consistent with similar estimates in literature details

Validation Test

- Won't target $\hat{\beta}_{l,h}$, $\hat{\beta}_{l,f}$ $\implies$ **validation test**
- model's predictions vs data $\implies$ **employment**

	Model	Data	
	$\beta_{l,i}(\Theta)$	$\widehat{\beta}_{l,i}$	95 % CI
$\Delta\tau^h$			
$\Delta\tau^f$			

Validation Test

- model's predictions vs data $\Longrightarrow$ **employment**

  $\Longrightarrow$ $\beta_{l,h}(\boldsymbol{\Theta})$ slightly underpredicts $\widehat{\beta}_{l,h} \approx 15\%$

	Model	Data	
	$\beta_{l,i}(\boldsymbol{\Theta})$	$\widehat{\beta}_{l,i}$	95 % CI
$\Delta\tau^h$	0.074	0.087	
$\Delta\tau^f$			

Validation Test

- model's predictions vs data $\Longrightarrow$ **employment**

  $\Longrightarrow$ $\beta_{l,f}(\Theta)$ overpredicts $\widehat{\beta}_{l,f} \approx 34\%$

	Model	Data	
	$\beta_{l,i}(\Theta)$	$\widehat{\beta}_{l,i}$	95 % CI
$\Delta\tau^h$	0.074	0.087	
$\Delta\tau^f$	0.061	0.045	

Validation Test

- model's predictions vs data $\Longrightarrow$ **employment**

$\Longrightarrow$ $\boldsymbol{\beta_{l,h}(\Theta)}$, $\boldsymbol{\beta_{l,f}(\Theta)}$ within **95% CI**

	Model	Data	
	$\beta_{l,i}(\Theta)$	$\widehat{\beta}_{l,i}$	95 % CI
$\Delta\tau^h$	0.074	0.087	[0.6,0.12]
$\Delta\tau^f$	0.061	0.045	[0.02,0.07]

Validation Test

- model's predictions vs data $\Longrightarrow$ **employment**

$\Longrightarrow$ $\beta_{l,h}(\Theta)$, $\beta_{l,f}(\Theta)$ within 95% CI

	Model	Data	
	$\beta_{l,i}(\Theta)$	$\widehat{\beta}_{l,i}$	95 % CI
$\Delta\tau^h$	0.074	0.087	[0.6,0.12]
$\Delta\tau^f$	0.061	0.045	[0.02,0.07]

$\Longrightarrow$ **model does a fair job predicting** $\hat{\beta}_{l,h}$ & $\hat{\beta}_{l,f}$

Employment Fluctuations, Real Estate Prices, and Property Taxes

Measuring the Housing Wealth and Firm Collateral Channel

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \boldsymbol{\delta}^{\textbf{coll}} + \delta_f^W + \delta_f^{P^h}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \delta^{\text{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Housing wealth channel

$$\uparrow \Delta\tau^h \text{ 1 pp} \implies \text{-0.074 pp}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \delta^{\text{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Housing wealth channel

$$\uparrow \ \Delta\tau^h \text{ 1 pp} \implies \text{-0.074 pp} \quad = \quad \underbrace{\text{-0.073 pp}}_{98\ \%}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \delta^{\text{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Housing wealth channel

$$\uparrow \Delta\tau^h \text{ 1 pp} \implies \text{-0.074 pp} = \underbrace{\text{-0.073 pp}}_{98\ \%} + (\text{-0.001})\text{ pp}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \delta^{\text{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Firm collateral channel

$$\uparrow \Delta\tau^f \text{ 1 pp} \implies \text{-0.061 pp}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \boldsymbol{\delta}^{\text{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Firm collateral channel

$$\uparrow \ \Delta\tau^f \text{ 1 pp} \implies \text{-0.061 pp} \quad = \quad \underbrace{\text{-0.052 pp}}_{84\ \%}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- decomposition result

$$\beta_{l,h} = \delta^{\text{wealth}} + \delta_h^W + \delta_h^{P^f}$$

$$\beta_{l,f} = \boldsymbol{\delta}^{\textbf{coll}} + \delta_f^W + \delta_f^{P^h}$$

  - Firm collateral channel

$$\uparrow \; \Delta\tau^f \text{ 1 pp} \implies \text{-0.061 pp} \quad = \underbrace{\text{-0.052 pp}}_{84\ \%} \quad + \quad (\text{-0.009}) \text{ pp}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- explain more than 80% decline in employment due to drop in real estate prices
  - Housing wealth channel

$$\uparrow \; \Delta\tau^h \; 1 \text{ pp} \implies \text{-0.074 pp} \quad = \quad \underbrace{\text{-0.073 pp}}_{98\ \%} \quad + \quad (\text{-0.001}) \text{ pp}$$

  - Firm collateral channel

$$\uparrow \; \Delta\tau^f \; 1 \text{ pp} \implies \text{-0.061 pp} \quad = \quad \underbrace{\text{-0.052 pp}}_{84\ \%} \quad + \quad (\text{-0.009}) \text{ pp}$$

Quantitative Results: Housing Wealth & Firm Collateral Channel

- explain more than 80% decline in employment due to drop in real estate prices

$\Longrightarrow$ induced by higher property taxes

– Housing wealth channel

$$\uparrow \Delta\tau^h \text{ 1 pp} \Longrightarrow \text{-0.074 pp} = \underbrace{\text{-0.073 pp}}_{98\ \%} + (\text{-0.001}) \text{ pp}$$

– Firm collateral channel

$$\uparrow \Delta\tau^f \text{ 1 pp} \Longrightarrow \text{-0.061 pp} = \underbrace{\text{-0.052 pp}}_{84\ \%} + (\text{-0.009}) \text{ pp}$$

Employment Fluctuations, Real Estate Prices, and Property Taxes

Conclusions

CONCLUSIONS

- **THIS PAPER:** unifying approach to model and quantify

  $\Longrightarrow$ housing wealth and firm collateral

Conclusions

- **THIS PAPER:** unifying approach to model and quantify

  $\Longrightarrow$ housing wealth and firm collateral

  - reduced form estimates $\Rightarrow$ 2012 Italian property tax reform $+$ DID
  - GE model $\rightarrow$ closed form decomposition $\Longrightarrow$ due to $\uparrow$ property taxes

Conclusions

- **THIS PAPER:** unifying approach to model and quantify

  $\Longrightarrow$ housing wealth and firm collateral

  - reduced form estimates $\Rightarrow$ 2012 Italian property tax reform $+$ DID
  - GE model $\rightarrow$ closed form decomposition $\Longrightarrow$ due to $\uparrow$ property taxes

- both channels explain more than 80%

  $\Longrightarrow$ $\downarrow$ employment drop after $\downarrow$ real estate prices

Future Work

EMPIRICAL ANALYSIS $\Longrightarrow$ firm level analysis using balance sheet data **ORBIS**

(i) How assets value and borrowing levels are changing?

MODEL $\Longrightarrow$ check robustness of decomposition results

(i) dynamics $\Longrightarrow$ role of expectations

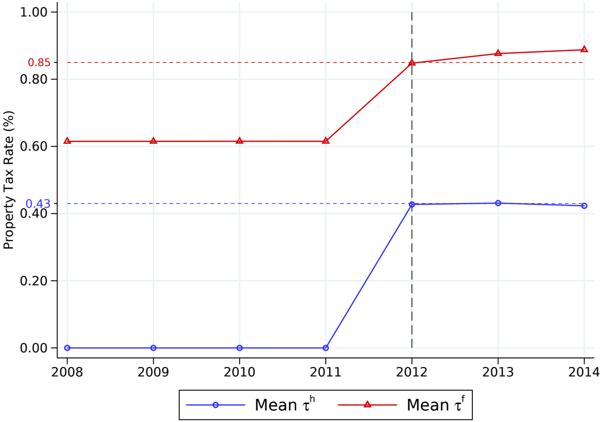
(ii) real estate market $\Longrightarrow$ demand + supply

(iii) financial intermediation $\Longrightarrow$ assets + role of interest rate

THANK YOU

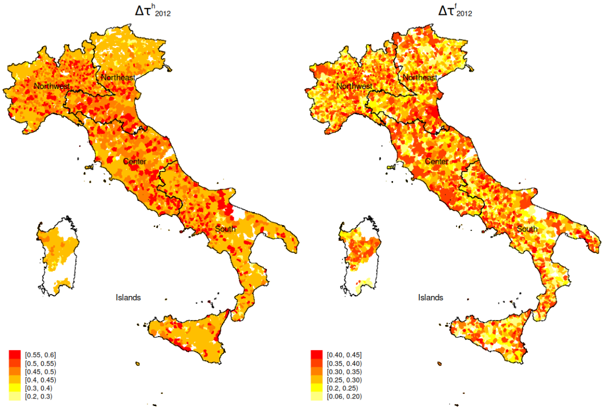
Sharp increase in τ^h & τ^f BACK

$\Delta\tau^h_{2012} \approx 322$ euros and $\Delta\tau^f_{2012} \approx 200$ euros



Large Variation in τ^h & τ^f BACK

$$Var(\Delta\tau^i_{2012}) \approx 5 \times Var(\Delta\tau^i_{t\neq 2012})\ i = \{h, f\}$$



First Stage Problem Households: FOC's BACK

- HH's multipliers λ: budget constraint and μ_h collateral constraint. solution

$$\{C\}: \quad \beta\, C^{\beta-1}\left(H^h\right)^{1-\beta} = \lambda + \mu^h$$

$$\{L\}: \quad \chi\, L^{\frac{1}{\nu}} = \lambda\, W$$

$$\left\{H^h\right\}: \quad (1-\beta)\, C^{\beta}\left(H^h\right)^{-\beta} = \lambda\, P^h(1+\tau^h) - \mu^h\, \phi_h\, P^h$$

$$C + P^h H^h (1+\tau^h) = WL + \Pi$$

$$\mu^h\left[C - \phi_h P^h H^h\right] = 0$$

First Stage Problem Households: FOC's BACK

- With foc's 1st stage, solving for $\{C, H^h, L^s, \mu_h, \lambda\}$:

$$C = \frac{\phi_h}{1+\tau^h+\phi_h}(WL+\Pi)$$

$$H^h = \frac{1}{P^h\left(1+\tau^h+\phi_h\right)}(WL+\Pi)$$

$$L^s = \left[\frac{W\phi_h^\beta}{\chi\left(P^h\right)^{1-\beta}\left(1+\tau^h+\phi_h\right)}\right]^\nu$$

$$\mu^h = \frac{1}{\left(\phi_h P^h\right)^{1-\beta}}\left[\beta - \frac{\phi_h}{1+\tau^h+\phi_h}\right]$$

$$\lambda = \frac{\phi_h^\beta}{\left(P^h\right)^{1-\beta}\left(1+\tau^h+\phi_h\right)}$$

Firms' Problem: FOC's BACK

- Firm's multiplier μ_j^f collateral constraint. solution

$$\{L_j\}: \quad \alpha\left(\frac{\epsilon-1}{\epsilon}\right) C^{\frac{1}{\epsilon}} L^{\alpha\left(\frac{\epsilon-1}{\epsilon}\right)-1}\left(H^h\right)^{(1-\alpha)\left(\frac{\epsilon-1}{\epsilon}\right)} = W(1+\mu_j^f)$$

$$\{H_j^f\}: \quad (1-\alpha)\left(\frac{\epsilon-1}{\epsilon}\right) C^{\frac{1}{\epsilon}} L_j^{\alpha\left(\frac{\epsilon-1}{\epsilon}\right)}\left(H_j^h\right)^{(1-\alpha)\left(\frac{\epsilon-1}{\epsilon}\right)-1} = P^f\left(1+\tau^f-\phi_f\,\mu_j^f\right)$$

$$\mu_j^f\left[WL_j-\phi_f P^f H_j^f\right]=0$$

Firms' Problem: Solution BACK

- With firms' foc's, solving for $\left\{L_j^d, H_j^f, \mu_j^f,\right\}$:

$$L_j^d = \left[\alpha\,\frac{\epsilon-1}{\epsilon}\right]^{\epsilon} \frac{C}{W^{1+\alpha(\epsilon-1)}\left(\phi_f P^f\right)^{(1-\alpha)(\epsilon-1)}(1+\mu_j^f)^{\epsilon}}$$

$$H_j^f = \left[(1-\alpha)\,\frac{\epsilon-1}{\epsilon}\right]^{\epsilon} \frac{\phi_f^{\alpha(\epsilon-1)}C}{W^{\alpha(\epsilon-1)}\left(P^f\right)^{1+(1-\alpha)(\epsilon-1)}(1+\tau^f-\phi_f\mu_j^f)^{\epsilon}}$$

$$\mu_j^f = \frac{\alpha\,(1+\tau^f+\phi_f)}{\phi_f} - 1$$

Competitive Equilibrium (Definition 1) BACK

A competitive equilibrium with binding constraints in this economy is defined by

- Prices $\left\{W, P^h, P^f, p_j\right\}$, allocations $\left\{L, H^h, H^f, C, c_j\right\}$
- Shadow values $\left\{\mu^h, \mu^f\right\}$ and property tax rates $\left\{\tau^h, \tau^f\right\}$

Such that:

1. Given $\left\{W, P^h, P^f, p_j\right\}$ and $\left\{\tau^h, \tau^f\right\}$
   1.1 L, H^h and C solve 1st stage problem with $\mu^h \geq 0$ and (c_j) solve 2nd stage problem.
   1.2 L and H^f maximize profits for firms with $\mu^f \geq 0$.
   1.3 H^h and H^f are consistent with real estate supply functions.
2. Given a $\left\{L, H^h, H^f\right\}$ and $\left\{\tau^h, \tau^f\right\}$
   2.1 $\left\{W, P^f, P^h\right\}$ clear the markets for labor, houses and commercial real estate respectively.

Binding Collateral Constraints (Proposition 2) BACK

Let $\{W, P^h, P^f,\}$ and $\{L, H^h, H^f, C,\}$ denote the equilibrium price and allocation vector.

- Then, the household's borrowing constraint binds (i.e., $\mu^h > 0$) if and only if:

$$\frac{C}{WL + \Pi} < \beta$$

- Furthermore, the firm's collateral constraint binds (i.e., $\mu_j^f > 0$) if and only if:

$$\frac{WL_j}{WL_j + P^f H^f (1 + \tau^f)} < \alpha$$

Log-Linear Equilibrium (Proposition 3) BACK

Let $\Theta = [\alpha, \beta, \nu, \epsilon, \sigma_f, \sigma_h, \phi_h, \phi_f]$. Then, the competitive equilibrium with binding financial constraints is represented by the following equations.

$$A_h \log(P^h) = \kappa_{P^h}(\Theta) + (1+\nu)\left[\log(W) - \log(1+\tau^h+\phi_h)\right] + \log(1+\tau^f+\epsilon\phi_f)$$

$$A_f \log(P^f) = \kappa_{P^f}(\Theta) + (1+\sigma_h)\log(P^h) - \alpha(\epsilon-1)\log(W) - \epsilon\log(1+\tau^f+\phi_f)$$

$$\log(L) = \log(\phi_f) + (1+\sigma_f)\log(P^f) - \log(W)$$

$$\log(C) = \log(\phi_h) + (1+\sigma_h)\log(P^h)$$

- $A_h = 1 + \sigma_h + (1-\beta)\nu$
- $A_f = 1 + \sigma_f + (1-\alpha)(\epsilon - 1)$
- $\kappa_{P^h}(\Theta)$, $\kappa_{P^f}(\Theta)$, $\kappa_W(\Theta)$ are a functions of Θ.

Tax Increase Reduced Form Effect (Proposition 3) BACK

For a given Θ, if $\frac{\tau^h}{1+\phi_h}$, $\frac{\tau^f}{1+\phi_f}$ and $\frac{\tau^f}{1+\epsilon\phi_f}$ are small enough the equilibrium response of $Y = \left\{P^h, P^f, L, C\right\}$ to an increase in property taxes equal to $(\Delta\tau^h, \Delta\tau^f)$ can be characterized as follows:

$$y \;=\; \beta_{y,h}(\Theta)\,\Delta\tau^h \;+\; \beta_{y,f}(\Theta)\,\Delta\tau^f$$

where is the $i = \{h, f\}$ and $\beta_{y,i}(\Theta)$ is the reduced form effect of a change in $\Delta\tau^i$ on y.

- $\Delta\tau^i = \tau_1^i - \tau_0^i$: percentage point change in the tax rate
- $\beta_{y,i}(\Theta)$: reduced form effect of change in $\Delta\tau^i$ on y.

Reduced Form Coefficients $\Delta\tau^h$ BACK

$$
\begin{aligned}
\beta_{l,h}(\Theta) &= (1+\sigma_f)\beta_{p^f,h}(\Theta) - \beta_{w,h}(\Theta) \\
\beta_{c,h}(\Theta) &= (1+\sigma_h)\beta_{p^h,h}(\Theta) \\
\beta_{p^h,h}(\Theta) &= -\frac{(1+\nu)\left[\alpha(\epsilon-1)(1+\sigma_f)+(1+\nu)A_f\right]}{A_{hf}(\epsilon-1)(1+\phi_h)} \\
\beta_{p^f,h}(\Theta) &= \frac{(1+\nu)\left[(1+\nu)(1+\sigma_h)-\alpha(\epsilon-1)(1-\beta)\nu\right]}{A_{hf}(\epsilon-1)(1+\phi_h)} \\
\beta_{w,h}(\Theta) &= -\frac{(1+\nu)\left[\sigma_f(1-\alpha)(1+\nu)+\alpha\nu(1+\sigma_f)\right]+\epsilon\phi_f(1+\nu)(1+\sigma_f)}{A_{hf}(\epsilon-1)(1+\phi_h)}
\end{aligned}
$$

$A_f = 1+\sigma_f+(1-\alpha)(\epsilon-1)$, $A_h = 1+\sigma_h+(1-\beta)\nu$

$A_{hf} = \alpha(1+\sigma_f)A_h + (1-\alpha)(1+\nu)(1+\sigma_h)$

Reduced Form Coefficients $\Delta\tau^f$ BACK

$$\beta_{l,f}(\Theta) = (1+\sigma_f)\beta_{p^f,f}(\Theta) - \beta_{w,f}(\Theta)$$

$$\beta_{c,f}(\Theta) = (1+\sigma_h)\beta_{p^h,f}(\Theta)$$

$$\beta_{p^h,f}(\Theta) = -\frac{(1+\phi_f)\left[(1-\alpha)(1+\nu)\sigma_f + \alpha\nu(1+\sigma_f)\right] + \epsilon\phi_f(1+\nu)(1+\sigma_f)}{A_{hf}(\epsilon-1)(1+\phi_f)(1+\epsilon\phi_f)}$$

$$\beta_{p^f,f}(\Theta) = -\frac{(1+\nu)(1+\sigma_h)(1+(\epsilon+1)\phi_f) + \alpha(1-\beta)\nu(1+\phi_f)}{A_{hf}(\epsilon-1)(1+\phi_f)(1+\epsilon\phi_f)}$$

$$\beta_{w,f}(\Theta) = -\frac{\left[1+\phi_f(\epsilon+1)\right]\left[(1+\sigma_h)+\sigma_f A_h\right] + (1-\beta)\nu\left[\alpha+(\epsilon+1)\phi_f\right]}{A_{hf}(\epsilon-1)(1+\phi_f)(1+\epsilon\phi_f)}$$

$A_f = 1+\sigma_f+(1-\alpha)(\epsilon-1)$, $A_h = 1+\sigma_h+(1-\beta)\nu$

$A_{hf} = \alpha(1+\sigma_f)A_h + (1-\alpha)(1+\nu)(1+\sigma_h)$

About Sample Representativeness BACK

- sample of 6,220 municipalities

  $\Longrightarrow$ representative for whole Italian economy

- for 2012

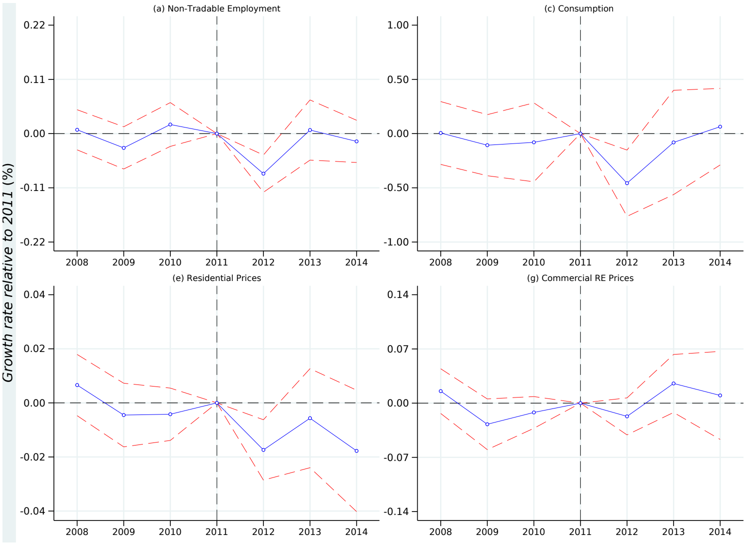
  (1) 77.75% of total municipalities ($\approx 8,000$)

  (2) 88% total population

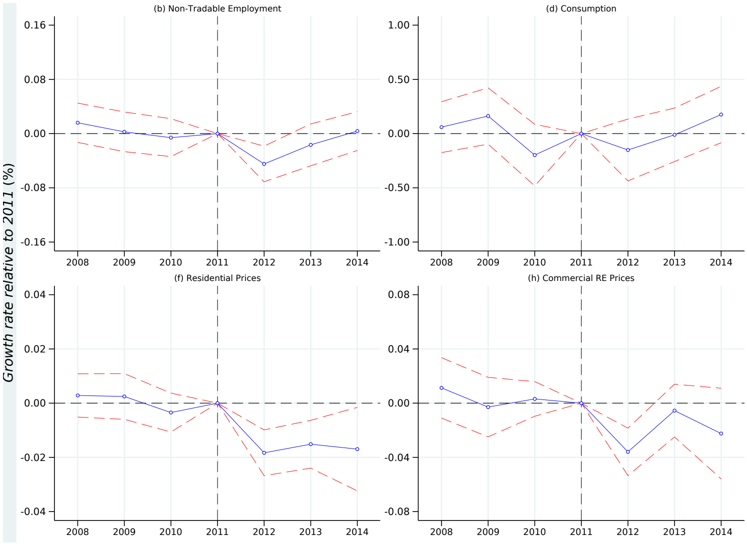
  (3) 89.5% total employment

  (4) 93% total income

Even Study: Dynamic coefficients $\Delta\tau^h$ BACK



Even Study: Dynamic coefficients $\Delta\tau^f$ BACK



Robustness Checks: Results

BACK

Tradables and Non-Tradables Definition

BACK

- Following Mian and Sufi (2014).

⋆ Tradable Industries:

- Sectoral world trade (Exports+Imports) important magnitude relative sector size/output.
- Economies of scale required ⇒ sector concentrated across the territory.

⋆ Non-Tradable Industries:

- No trade across locations or with rest of the world.
- Non-tradable sectors satisfy local demand ⇒ uniformly dispersed across territory.

Non-Trad Trad

Tradables and Non-Tradables Definition

BACK

- Let s be a 2-Digit (NACE Rev.2) industry code.
- using 2011 cross-section distribution:
  - Sector s Total Trade with ROW per employed person:

$$\text{Trade}_s^E = \frac{X_s + M_s}{E_s}$$

  - Sector s Total Trade with ROW relative to Gross Output:

$$\text{Trade}_s^Y = \frac{X_s + M_s}{Y_s}$$

  - Sector s Herfindahl-Hirschman Index (HHI):

$$HHI_s = \sum_m \left(\frac{E_{s,m}}{\sum_{m'} E_{s,m}} \right)$$

Non-Trad Trad

Tradables and Non-Tradables Definition

BACK

- Procedure:
  1. If $X_s + M_s > 0$:
  $$\text{Trade}^E_s > \text{Trade}^E_{\text{Median}} \text{ or } \text{Trade}^Y_s > \text{Trade}^Y_{\text{Median}} \Rightarrow s \in \text{ Tradable}$$
  2. If $X_s + M_s > 0$ and 1. is not satisfied:
  $$HHI_s > HHI_{\text{P75}^{\text{th}}} \Rightarrow s \in \text{ Tradable}$$
  3. If $X_s + M_s = 0$:
  $$HHI_s > HHI_{\text{P75}^{\text{th}}} \Rightarrow s \in \text{ Tradable}$$
  $$HHI_s < HHI_{\text{P25}^{\text{th}}} \Rightarrow s \in \text{ Non-Tradable}$$
- Thresholds:
$$\text{Trade}^E_{\text{Median}} = 56487 \ \& \ \text{Trade}^Y_{\text{Median}} = 0.16$$
$$HHI_{\text{P25}^{\text{th}}} = 0.0045 \ \& \ HHI_{\text{P75}^{\text{th}}} = 0.015$$

Non-Trad Trad

Non-Tradable NACE Industries BACK

- # Non-Tradable Industries = 7 (Exclude Construction Sector)
- Mean **HHI** Non-Tradables = 0.0068

Division	Division Name	Section	HHI
49	Land transport and transport via pipelines	H	0.0092
55	Accommodation	I	0.0075
46	Wholesale trade	G	0.0078
56	Food and beverage service activities	I	0.0074
47	Retail trade	G	0.0056
33	Repair & inst. of machinery & equip.	C	0.0051
45	Wholesale and retail trade vehicles & motorcycles	G	0.0043
43	Specialised construction activities	F	0.0032
42	Civil Engineering	F	0.0034
41	Construction of buildings	F	0.0035

Back to TNT def

Tradable NACE Industries: Part A

BACK

- # Tradable Industries = 28
- Mean **HHI** Tradables = 0.017

Division	Name	Section	$Trade^E$	$Trade^Y$	HHI
19	Manuf. coke & petroleum	C	595208	0.31	0.03
20	Manuf. chemicals	C	487905	0.79	0.013
29	Manuf. vehicles	C	336130	0.79	0.03
24	Manuf. basic metals	C	285574	0.6	0.017
26	Manuf. computer/elect/opt	C	239425	0.44	0.027
21	Manuf. Pharma	C	218005	0.9	0.013
30	Manuf. other transport equip.	C	156098	0.17	0.013
10	Manuf. food products	C	138202	0.2	0.002
28	Manuf. machinery and equip.	C	135429	0.27	0.003
17	Manuf. paper/products	C	131726	0.29	0.004
27	Manuf. electrical equip.	C	116954	0.24	0.003
15	Manuf. leather/products	C	108611	0.67	0.009

Back to TNT def

Tradable NACE Industries: Part B BACK

Division	Name	Section	$Trade^E$	$Trade^Y$	HHI
32	Other manuf.	C	89349	0.13	0.008
22	Manuf. rubber/plastic	C	82638	0.23	0.002
13	Manuf. textiles	C	75699	0.44	0.009
14	Manuf. wearing apparel	C	73500	0.59	0.003
23	Manuf. other non-metalic	C	49033	0.25	0.003
31	Manuf. furniture	C	28915	0.22	0.005
61	Telecom.	H			0.03
53	Postal/courier serv.	J			0.03
63	Information serv.	J			0.035
62	Computer programming serv.	J			0.036
93	Sport/Recreation activ.	R			0.06
50	Water transport	H			0.115
65	Insurance/pension funding	K			0.132
60	Broadcast. activ.	J			0.17
51	Air transport	H			0.305
12	Manuf. tobacco	C			0.338

Back to TNT def

Household Consumption on Vehicles

BACK

- Idea: Mian, Rao and Sufi (2013)

$$X^{\text{cars}}_{m,t} = \omega_{m,t} \cdot X^{\text{cars}}_{t}, \;\; \omega_{m,t} = \frac{P^{\text{Cars}}_{m,t} \; Q^{\text{Cars}}_{m,t}}{P^{\text{Cars}}_{t} \; Q^{\text{Cars}}_{t}}$$

- Assume:

$$\frac{P^{Cars}_{m,t}}{P^{\text{Cars}}_{t}} = p^{\text{cars}}_{m} \;\Rightarrow\; X^{\text{cars}}_{m,t} \;\propto\; \omega^{Q}_{m,t} \cdot X^{\text{cars}}_{t} = \frac{Q^{\text{Cars}}_{m,t}}{Q^{\text{Cars}}_{t}} \cdot X^{\text{cars}}_{t}$$

- Data new vehicles registrations 2009-2015

$$\hat{\omega}^{Q}_{m,t} = \frac{\text{New Cars Registered}_{m,t}}{\sum_m \;\text{New Cars Registered}_{m,t}}$$

- Durable Expenditure proxy $C^{dur}_{m,t}$:

$$C^{dur}_{m,t} = \hat{\omega}^{Q}_{m,t} \cdot C^{\text{cars}}_{t}$$

C^{cars}_{t}= Household Final Expenditure, Purchase of Vehicles at t

---

Car definition

Vehicle categories:

(1) Cars.

(2) Bus.

(3) Trucks for Goods Transport.

(4) Vehicles for Special Use.

(5) Motorcycles.

(6) Motorcycles & Quadricycles for Special Use.

(7) Trailers & Semi-Trailers for Goods Transport.

(8) Trailers & Semi-Trailers for Special Use.

(9) Tractors.

Cars

Vehicles intended for the transport of persons, with a maximum of nine seats, including that of driver

Real State Prices: Real State Observatory (OMI) Back

- **Homogeneous real state markets** within m (OMI zones).
- Data on property and rental values (per m^2)
  - Based on restricted data on transactions across Italy + Surveys local housing markets.
  - Only Minimum and maximum values reported.
  - By type of property and maintenance state.
  - Biannual frequency, period 2007H1-2014H2.
- **Annual real state price**: Average values across OMI zones for second semester of each year.

Summary Statistics: Main Variables

BACK

Summary Statistics - 2012: Municipal Level Variables

	Mean	S.D	P^{25}	P^{50}	P^{75}
Population	8,278	44,961	1,209	2,819	6,919
Area (mi^2)	58.38	108.65	8.63	21.79	54.39
Income^{pc}	11,376	2,961	8,854	11,740	13,469
L^{tot}	2,193	16,502	139	489	1,554
share L^{ntrad} (%)	41	14	31	41	50
share L^{trad} (%)	17	15	4	12	26
$\Delta\tau^h$	0.43	0.07	0.40	0.40	0.50
$\Delta\tau^f$	0.24	0.10	0.16	0.25	0.31
ΔL^{tot}	-0.17	7.47	-3.52	-0.67	2.54
ΔL^{ntrad}	2.44	7.95	-2.20	1.28	5.67
ΔL^{trad}	-2.08	19.35	-7.73	-1.02	3.36
ΔC	-5.09	71.58	-57.17	-9.61	30.07
ΔP^{House}	-1.81	4.03	-4.06	0.00	0.00
ΔP^{CRE}	-1.88	3.43	-3.02	0.00	0.00

Summary Statistics: Local Government Finances

BACK

Summary Statistics - 2012: Local Government Municipal Level

	Mean	S.D	P^{25}	P^{50}	P^{75}
ΔT^{c}_{pc}	1.3	13.8	-6.7	-0.2	8.9
ΔG^{c}_{pc}	-4.6	10.6	-11.0	-4.2	1.8
ΔT^{trans}_{pc}	-17.0	47.1	-43.3	-17.4	12.1
ΔT^{prin}_{pc}	14.8	85.1	-6.1	15.2	33.1
ΔT^{sec}_{pc}	139.9	110.3	172.9	195.2	200.0
Deficit/T^{c}	-9.4	9.6	-15.3	-9.3	-3.9
Debt/T^{c}	90.1	65.6	42.5	78.3	124.7
T^{irpef}/T^{c}	7.1	4.3	4.2	7.3	9.2
T^{prop}/T^{c}	26.2	11.2	19.6	27.0	33.2
T^{trans}/T^{c}	34.3	25.8	17.7	28.5	41.7

Summary Statistics: Main Variables BACK

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ΔC	-5.09	71.58	-57.17	-9.61	30.07
ΔP^{House}	-1.81	4.03	-4.06	0.00	0.00
ΔP^{CRE}	-1.88	3.43	-3.02	0.00	0.00

Summary Statistics: Local Government Finances BACK

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T^{trans}/T^{c}	34.3	25.8	17.7	28.5	41.7

Productivity Hypothesis: Implementation

BACK

- baseline specification

$$y_{m,t}^{\text{Baseline}} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\, \Delta\tau_{m,t}^{h} \times 1\{t = 2012\} + \beta_{y,f}\, \Delta\tau_{m,t}^{f} \times 1\{t = 2012\}$$

- productivity shocks $\Longrightarrow z_{m,t-1}$

$$y_{m,t} = y_{m,t}^{\text{Baseline}} + \omega_{y,h}^{z}\, \Delta\tau_{m,2012}^{h} \times z_{m,t-1} + \omega_{y,f}^{z}\, \Delta\tau_{m,2012}^{f} \times z_{m,t-1} + \epsilon_{m,t}$$

  - $Z_{m,t} =$ Real total income per employee (2010=100)
  - $z_{m,t} = \frac{Z_{m,t} - Z_{m,t-1}}{(Z_{m,t} + Z_{m,t-1})/2}$

Credit Supply Hypothesis: Implementation

BACK

- baseline specification

$$y_{m,t}^{\text{Baseline}} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\, \Delta\tau_{m,t}^{h} \times 1\{t = 2012\} + \beta_{y,f}\, \Delta\tau_{m,t}^{f} \times 1\{t = 2012\}$$

- credit supply shocks $\Longrightarrow \left(\frac{\text{Loan}}{Deposits}\right)_{m,t-1}$

$$y_{m,t} = y_{m,t}^{\text{Baseline}} + \omega_{y,h}^{\text{loan}}\, \Delta\tau_{m,2012}^{h} \times \left(\frac{\text{Loan}}{Deposits}\right)_{m,t-1} + \omega_{y,f}^{\text{loan}}\, \Delta\tau_{m,2012}^{f} \times \left(\frac{\text{Loan}}{Deposits}\right)_{m,t-1} + \epsilon_{m,t}^{4}$$

  - Loans and Deposits of all bank branches within municipality

Uncertainty Hypothesis: Implementation

BACK

- baseline specification

$$y_{m,t}^{\text{Baseline}} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\,\Delta\tau_{m,t}^{h} \times 1\{t = 2012\} + \beta_{y,f}\,\Delta\tau_{m,t}^{f} \times 1\{t = 2012\}$$

- uncertainty shocks $\Longrightarrow \sigma_{\text{P},t-1}^{z}$

$$y_{m,t} = y_{m,t}^{\text{Baseline}} + \omega_{y,h}^{\text{uncert}}\,\Delta\tau_{m,2012}^{h} \times \sigma_{\text{P},t-1}^{z} + \omega_{y,f}^{\text{uncert}}\,\Delta\tau_{m,2012}^{f} \times \sigma_{\text{P},t-1}^{z} + \epsilon_{m,t}$$

  - $\sigma_{\text{P},t-1}^{z}$: sample standard deviation z across municipalities within province P

$$\sigma_{\text{P},t}^{z} = \sqrt{\frac{1}{N_{m\in \text{P}} - 1}\sum_{m\in p}\left[z_{m,t} - \bar{z}_{\text{P},t}\right]^2}$$

$$\bar{z}_{\text{P},t} = \frac{1}{N_{m\in \text{P}}}\sum_{m\in p} z_{m,t}$$

Additional Covariates: Implementation BACK

- baseline specification

$$y_{m,t}^{\text{Baseline}} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\,\Delta\tau_{m,t}^{h} \times 1\{t = 2012\} + \beta_{y,f}\,\Delta\tau_{m,t}^{f} \times 1\{t = 2012\}$$

- controlling for municipal time varying covariates $\Longrightarrow X_{m,t-1}$

$$y_{m,t} = y_{m,t}^{\text{Baseline}} + X_{m,t-1}\boldsymbol{\Gamma} + \epsilon_{m,t}$$

$X_{m,t-1}$ includes:

- Local economic conditions details
- Supply Side Controls details
- Local Government Controls details
- Other Local Tax Policy Changes details

Local economic conditions BACK

(1) Growth rate income per-capita (2010=100).

(2) Log-level income per-capita (2010=100).

(3) Growth rate total employment.

(4) Growth rate total employment in local labor market.

(5) Net Internal Migration rate:

$$\frac{\text{\# Move in to } m - \text{\# Move out from } m}{\text{Population}_m}$$

Supply Side Controls

BACK

(1) Employment share 1-digit NACE Rev.2: For $j = \{C, D, E, F, ..., R, S\}$.

$$\text{Share Employment}_{m,j} = \frac{E_{m,j}}{\sum_{j=C}^{S} E_{m,j}}$$

- Example:
  - $C =$ Manufactures.
  - $F =$ Construction.
  - $G =$ Wholesale and Retail Trade.
- Employment for A and B is restricted data, so I exclude both divisions from sample.

Local Government Controls BACK

(1) Growth rate Current Revenues (2010=100).

(2) Growth rate Current Expenditure (2010=100).

(3) Share Revenues Income Surcharge (IRPEF).

(4) Share Revenues Property Taxes.

(5) Share Revenues Transfers General and Regional Government.

(6) Total Debt-Current Revenue ratio.

(7) Interest Expenditure-Current Expenditure ratio.

(8) Capital Expenditure-Current Expenditure ratio.

(9) Revenues from Transfers-Current Revenue ratio.

(10) Property Taxes Revenue-Current Revenue ratio.

Other Local Tax Policy Changes BACK

(1) 2008 Exemption of Main Residence from households:

$$1\{t = 2008\} \times \Delta\tau^{prin}_{m,2008}$$

(2) 2011 Tax Income changes.

$$1\{t = 2011\} \times Ln\left(\frac{R_{m,\text{IRPEF}}}{\text{Population}_{m,2011}}\right)$$

(3) 2014 Property tax changes.

$$1\{t = 2014\} \times Ln\left(\frac{R_{m,\text{TASI}}}{\text{Population}_{m,2013}}\right)$$

Spillover Effects: Implementation BACK

- baseline specification

$$y_{m,t}^{\text{Baseline}} = \text{FE}_m + \text{FE}_t + \beta_{y,h}\ \Delta\tau_{m,t}^{h} \times 1\{t=2012\} + \beta_{y,f}\ \Delta\tau_{m,t}^{f} \times 1\{t=2012\}$$

- controlling for local labor market trends $\Longrightarrow \delta_{m\in \text{LLS},t} = \text{FE}_{\text{LLS}} \times \text{FE}_t$

$$y_{m,t} = y_{m,t}^{\text{Baseline}} + \delta_{m\in \text{LLS},t} + \epsilon_{m,t}$$

Local Labor Market (LLS) $\Longrightarrow$ Commuting Zones

- Group of neighbor municipalities
- Labor force lives and works
- Establishments can find most of the labor force

Testing for Parallel Trends: Implementation BACK

- event study analysis approach

$$y_{m,t} = \text{FE}_m + \text{FE}_t + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,h} 1\{t = \tilde{t}\} \times \Delta\tau^h_{m,2012} + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,f} 1\{t = \tilde{t}\} \times \Delta\tau^f_{m,2012} + \epsilon_{m,t}$$

- lead coefficients $\Longrightarrow$ pre-tax reform trend differences
  - $\beta^{2008}_{y,i}$ $\beta^{2009}_{y,i}$ $\beta^{2010}_{y,i}$
  - Base year 2011 $\Longrightarrow \beta^{2011}_{y,i} = 1$
- testing for parallel trends

$$H_o: \ \beta^{2008}_{y,i} = \beta^{2009}_{y,i} = \beta^{2010}_{y,i} = 0$$

Testing for Parallel Trends: Implementation BACK

- event study analysis approach

$$y_{m,t} = \text{FE}_m + \text{FE}_t + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,h} 1\{t = \tilde{t}\} \times \Delta\tau^h_{m,2012} + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,f} 1\{t = \tilde{t}\} \times \Delta\tau^f_{m,2012} + \epsilon_{m,t}$$

- testing for parallel trends

$$H_o : \ \beta^{2008}_{y,i} = \beta^{2009}_{y,i} = \beta^{2010}_{y,i} = 0$$

- RESULTS $\Rightarrow$ no trend differences
  - for $\Delta\tau^h$: results
  - for $\Delta\tau^f$: results

Testing for Parallel Trends: Implementation BACK

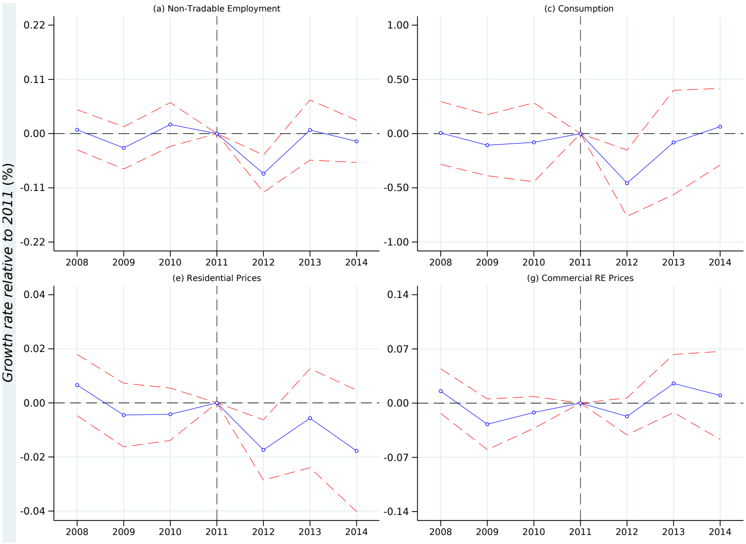
- event study analysis approach

$$y_{m,t} = \mathrm{FE}_m + \mathrm{FE}_t + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,h} 1\{t = \tilde{t}\} \times \Delta\tau^{h}_{m,2012} + \sum_{\tilde{t} \neq 2011} \beta^{\tilde{t}}_{y,f} 1\{t = \tilde{t}\} \times \Delta\tau^{f}_{m,2012} + \epsilon_{m,t}$$

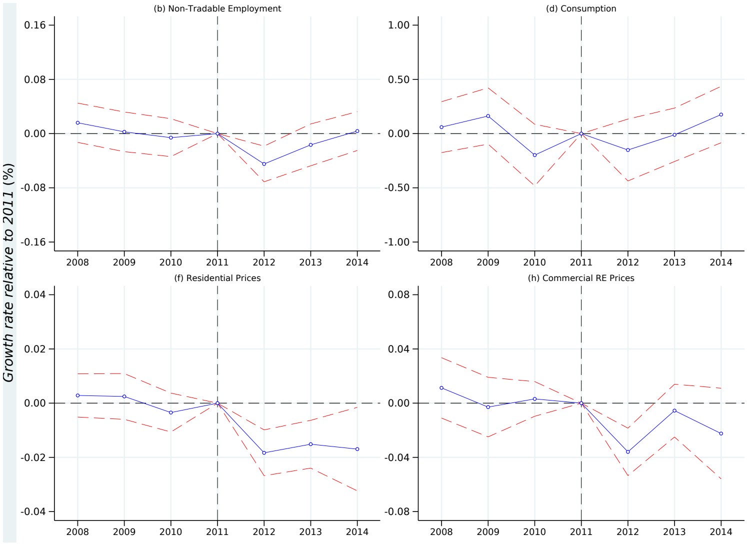
- no trend differences $\Longrightarrow$ consistent with **Alesina and Paradisi (2017)**
  - Primarily explained by the staggered timing of local elections
  - Completely unrelated to business cycle fluctuations determinants
  - Timing of elections is as good as random assignment

Even Study: Dynamic coefficients $\Delta\tau^h$

BACK



Even Study: Dynamic coefficients $\Delta\tau^f$ BACK



Balancing Across Treatment Intensity Groups: Implementation BACK

- examine the similarities across municipalities with different $\Delta\tau^h$ & $\Delta\tau^f$
- $\Delta\tau^h$ & $\Delta\tau^f$ $\Longleftrightarrow$ compositional changes for other observable characteristics
- following Wing et al.(2018)

$$x_{m,t} = \text{FE}_m + \text{FE}_t + \theta_{x,h}\,\Delta\tau^h_{m,2012} + \theta_{x,f}\,\Delta\tau^f_{m,2012} + \mu_{m,t} \tag{8}$$

$\mathbf{x_{m,t}}$

- local economic and financial conditions details
- industry employment shares details
- migration patterns details
- financial conditions of local governments details

Balancing Across Treatment Intensity Groups: Implementation BACK

- examine the similarities across municipalities with different $\Delta\tau^h$ & $\Delta\tau^f$
- $\Delta\tau^h$ & $\Delta\tau^f \Longleftrightarrow$ compositional changes for other observable characteristics
- following Wing et al.(2018)

$$x_{m,t} = \text{FE}_m + \text{FE}_t + \theta_{x,h}\,\Delta\tau^h_{m,2012} + \theta_{x,f}\,\Delta\tau^f_{m,2012} + \mu_{m,t} \qquad (8)$$

- testing for no compositional changes

$$Ho : \theta_{x,h} = \theta_{x,f} = 0$$

$\Longrightarrow$ *RHo* $\Longrightarrow$ evidence of imbalances across municipalities

Local Economic and Financial Conditions

BACK

(1) growth rate of income per capita ($\Delta \text{Income}^{pc}$)

(2) log of income per capita (Income^{pc})

(3) log deposits (Depos)

(4) log loans (Loan)

Industry Employment Shares BACK

(1) Employment share 1-digit NACE Rev.2:

$$\text{Share Employment}_{m,j} = \frac{E_{m,j}}{\sum_{j=C}^{S} E_{m,j}}$$

- For $j = \{C, F, G\}$.
  - C = Manufactures (shL_{man})
  - F = Construction (shL_{cons})
  - G = Wholesale and Retail Trade (shL_{ret})

Migration Patterns BACK

(1) In-Migration rate (Mig^{In})

$$\frac{\#\text{ Move in to } m}{\text{Population}_m}$$

(2) Out-Migration rate (Mig^{Out})

$$\frac{\#\text{ Move out from } m}{\text{Population}_m}$$

Financial Conditions of Local Governments BACK

(1) per capita real growth rate for current revenues (ΔT_C)

(2) per capita real growth rate for current expenditures (ΔG_C)

(3) investment rate (G^K/G^C) $\Longrightarrow$ capital expenditure-current expenditure ratio

(4) Total Debt-Current Revenue ratio.

(5) deficit-to-revenues ratio (Deficit$/T_C$)

Covariate Balance: Local Economic and Financial Conditions

BACK

	Income Growth ($\theta_{\Delta \text{Inc}^{pc},i}$)	Income ($\theta_{\text{Inc}^{pc},i}$)	Loans ($\theta_{\text{Loans},i}$)	Deposits ($\theta_{\text{Depos},i}$)
$\Delta\tau^{h}_{m,2012}$	-0.001	-0.002	-0.009	0.028
	(0.007)	(0.004)	(0.025)	(0.022)
$\Delta\tau^{f}_{m,2012}$	-0.008	-0.002	-0.001	0.004
	(0.005)	(0.004)	(0.016)	(0.017)
$Ho : \theta_{x,h} = \theta_{x,f} = 0$ (p-val)	0.25	0.77	0.93	0.42
N_{obs}	43,540	43,540	14,185	14,185
N_{mun}	6,220	6,220	2,089	2,089
$\bar{R}^2$	0.10	0.99	0.99	0.99

Covariate Balance: Migration Patterns and Labor Shares BACK

	Migration Rate		Employment Share		
	In	Out	Manuf.	Const.	Retail
	$(\theta_{\text{Mig}^{\text{in}},i})$	$(\theta_{\text{Mig}^{\text{out}},i})$	$(\theta_{\text{sh } L^{\text{man}},i})$	$(\theta_{\text{sh } L^{\text{cons}},i})$	$(\theta_{\text{sh } L^{\text{ret}},i})$
$\Delta\tau^{h}_{m,2012}$	0.002	0.001	0.004	0.010**	0.000
	(0.002)	(0.002)	(0.005)	(0.005)	(0.005)
$\Delta\tau^{f}_{m,2012}$	0.001	-0.001	-0.004	0.002	-0.001
	(0.001)	(0.001)	(0.004)	(0.004)	(0.003)
$Ho : \theta_{x,h} = \theta_{x,f} = 0$ (p-val)	0.39	0.73	0.51	0.10	0.94
N_{obs}	43,540	43,540	43,540	43,540	43,540
N_{mun}	6,220	6,220	6,220	6,220	6,220
$\bar{R}^2$	0.40	0.62	0.96	0.90	0.90

Covariate Balance: Financial Situation of Local Governments

BACK

	Rev. Growth ($\theta_{\Delta T^c,i}$)	Expend. Growth ($\theta_{\Delta G^c,i}$)	Investment Rate ($\theta_{G^K/G^c,i}$)	Deficit-to-T^c Ratio ($\theta_{\text{Deficit}/T^c,i}$)	Debt-to-T^c Ratio ($\theta_{B/T^c,i}$)
$\Delta\tau^h_{m,2012}$	0.072**	-0.065**	-0.025	-0.137***	-0.122*
	(0.032)	(0.029)	(0.057)	(0.024)	(0.069)
$\Delta\tau^f_{m,2012}$	0.20***	-0.006	-0.052	-0.175***	-0.143***
	(0.024)	(0.025)	(0.046)	(0.015)	(0.047)
$Ho : \theta_{x,h} = \theta_{x,f} = 0$ (p-val)	0.00	0.10	0.46	0.00	0.01
N_{obs}	43,519	43,519	43,540	43,519	43,519
N_{mun}	10,158	10,158	6,220	10,158	10,158
$\bar{R}^2$	0.92	0.93	0.53	0.27	0.59

Calibration vs Literature BACK

- Using 2012 Survey of Households, Income and Wealth (SHIW) for Italy
- Average LTV-ratio

	Parameter	Value	Target
Supply elast. houses	σ_h	4.87	$\hat{\beta}_{P^h,h}$
Supply elast. CRE	σ_f	2.40	$\hat{\beta}_{P^f,f}$
LTV HH's	ϕ_h	0.23	$\hat{\beta}_{C,h}$
LTV firms	ϕ_f	0.35	$\hat{\beta}_{P^h,f}$

Calibration vs Literature

BACK

- Using 2012 Survey of Households, Income and Wealth (SHIW) for Italy
- Average LTV-ratio
  - For hh's that own single home $\Rightarrow$ 0.42
  - For hh's own CRE and don't rent it $\Rightarrow$ 0.50

	Parameter	Value	Target
Supply elast. houses	σ_h	4.87	$\hat{\beta}_{P^h,h}$
Supply elast. CRE	σ_f	2.40	$\hat{\beta}_{P^f,f}$
LTV HH's	ϕ_h	0.23	$\hat{\beta}_{C,h}$
LTV firms	ϕ_f	0.35	$\hat{\beta}_{P^h,f}$

Calibration vs Literature

BACK

- For $\sigma_h \Rightarrow$ benchmark Saiz (2010)
  - Instrument $\Delta H^{h,d} \Rightarrow$ industrial shares, migration and hours of sun
  - Estimated value $\approx$ 16.67 (See TABLE III, column (4))
  - Use data change in housing prices for 1970-2000

	Parameter	Value	Target
Supply elast. houses	σ_h	4.87	$\hat{\beta}_{P^h,h}$
Supply elast. CRE	σ_f	2.40	$\hat{\beta}_{P^f,f}$
LTV HH's	ϕ_h	0.23	$\hat{\beta}_{C,h}$
LTV firms	ϕ_f	0.35	$\hat{\beta}_{P^h,f}$

About Economic Significance BACK

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
$\Delta\tau^h_{m,t} \times 1\{t = 2012\}$	-0.087***	-0.517***	-0.022**	-0.005
	(0.015)	(0.145)	(0.009)	(0.010)
$\Delta\tau^f_{m,t} \times 1\{t = 2012\}$	-0.045***	-0.177	-0.017***	-0.032***
	(0.011)	(0.120)	(0.006)	(0.008)
$IQR_y/\widehat{IQR}_{y,h}(\%)$	11.0	5.9	5.5	1.6
$IQR_y/\widehat{IQR}_{y,f}(\%)$	8.5	0.87	6.3	15.7

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Baseline Results BACK

	Non-Tradable Employment $\widehat{\beta}_{l,i}$	Consumption Expenditure $\widehat{\beta}_{c,i}$	Housing Price $\widehat{\beta}_{p^h,i}$	Commercial RE Price $\widehat{\beta}_{p^f,i}$
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Baseline Results

BACK

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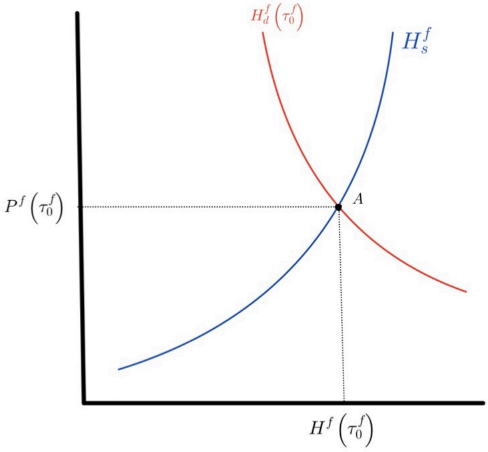
	(0.011)	(0.120)	(0.006)	(0.008)

$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Firm Collateral Channel: Intuition BACK

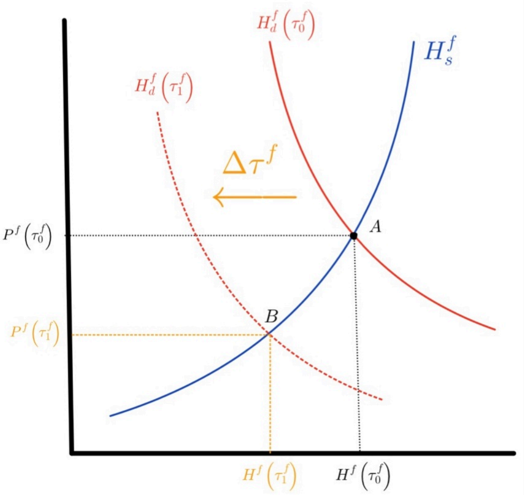
- CRE market



Firm Collateral Channel: Intuition

BACK

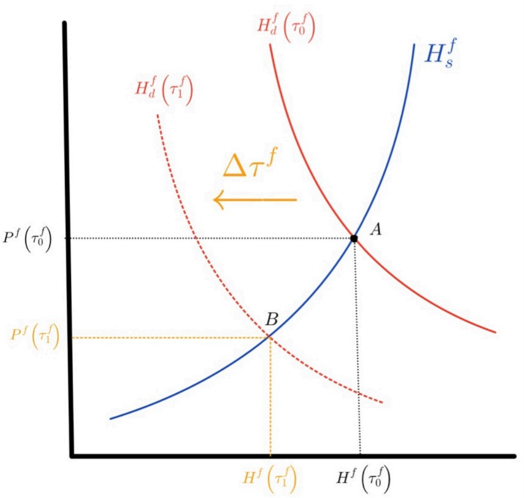
- CRE market $\Longrightarrow \uparrow \tau^f$



Firm Collateral Channel: Intuition

BACK

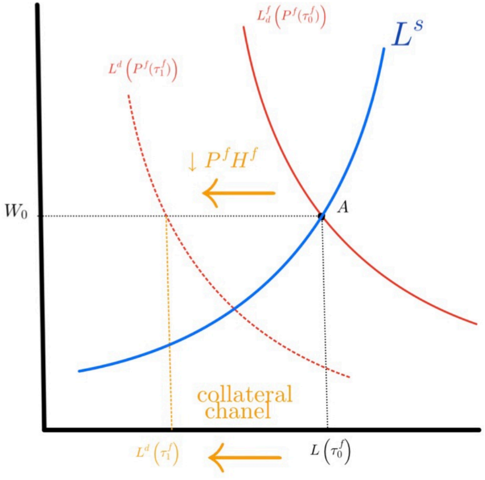
- CRE market $\Longrightarrow \uparrow \tau^f \Longrightarrow \downarrow P^f$ and $\downarrow H^f$



Firm Collateral Channel: Intuition

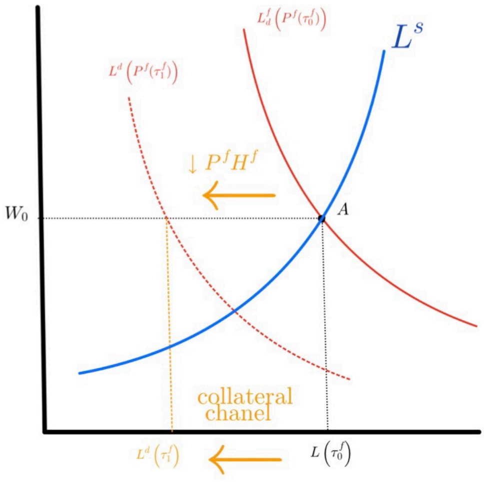
BACK

- Labor market $\rightarrow \uparrow \tau^f \implies \downarrow P^f H^f$



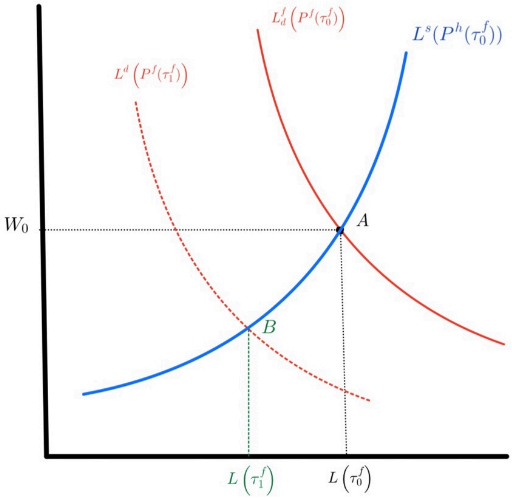
GE ADJUSTMENT: INTUITION BACK

- Labor market $\rightarrow \uparrow \tau^f \implies \downarrow P^f H^f$



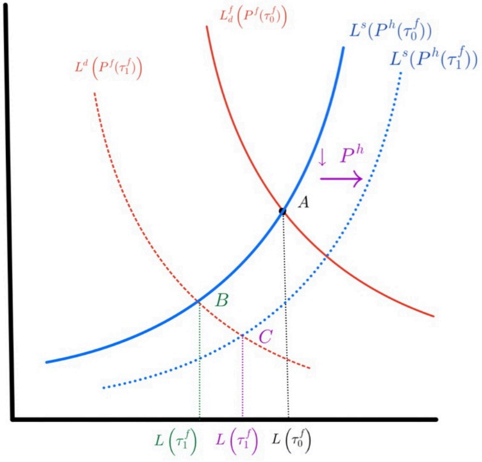
GE ADJUSTMENT: INTUITION BACK

- Labor market $\rightarrow \uparrow \tau^f \implies$ adjustment along labor supply



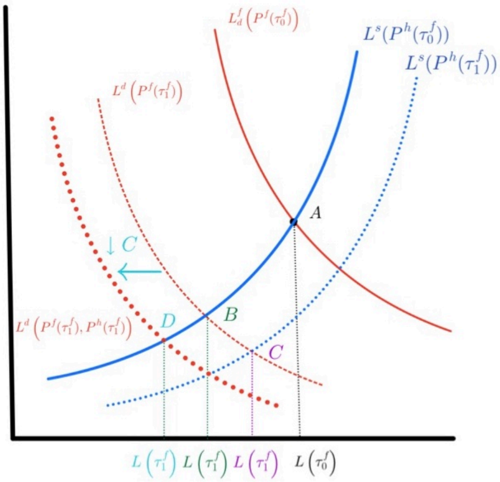
GE Adjustment: Intuition BACK

- Labor market $\rightarrow \uparrow \tau^f \rightarrow \downarrow P^h \implies$ wealth effect labor supply



GE Adjustment: Intuition BACK

- Labor market $\rightarrow \uparrow \tau^f \rightarrow \downarrow C \Longrightarrow \downarrow L^d$



GE Adjustment: Intuition BACK

- Labor market $\rightarrow \uparrow \tau^f \implies$ GE adjustment of P^h and W