Employment Fluctuations, Real Estate Prices and Property Taxes

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Motivation

- Drop in real estate prices associated with employment declines

$$\#\text{ real estate price} \quad \not! \quad \#\text{ employment}$$

- Two explanations
  - (i) Housing Wealth Channel
    -) Mian and Sufi (2014), Chodorow-Reich et al. (2013)
  - (ii) Firm Collateral Channel
    -) Liu, Miao and Zha (2016), Bahja et al. (2020)

Go to Road Map

Motivation

- Drop in real estate prices associated with employment declines

$$\#\text{ real estate price} \quad ! \quad \#\text{ employment}$$

- Two explanations

  (i) Housing Wealth Channel

$$\#\text{ house prices} \quad ! \quad \#\text{ employment}$$

  (ii) Firm Collateral Channel

$$\#\text{ commercial real estate (CRE) prices} \quad ! \quad \#\text{ employment}$$

Go to Road Map

Motivation

- Drop in real estate prices associated with employment declines

  # real estate price ! # employment

- Two explanations

  (i) Housing Wealth Channel

  # residential prices ! # hh's wealth ! # consumption (constrained hh's)

Go to Road Map

Motivation

- Drop in real estate prices associated with employment declines

$$\#\text{ real estate price} \quad ! \quad \#\text{ employment}$$

- Two explanations

  (i) Housing Wealth Channel

$$\#\text{ residential prices} \quad ! \quad \#\text{ hh's wealth} \quad ! \quad \#\text{ demand for goods} \quad ! \quad \#\text{ firm's labor demand}$$

Go to Road Map

Motivation

- Drop in real estate prices associated with employment declines

$$\#\text{ real estate price} \quad ! \quad \#\text{ employment}$$

- Two explanations

  (ii) Firm Collateral Channel

$$\#\text{ CRE prices} \quad ! \quad \#\text{ value real estate assets} \quad ! \quad \#\text{ collateral value}$$

Motivation

- Drop in real estate prices associated with employment declines

$$\#\text{ real estate price} \quad ! \quad \#\text{ employment}$$

- Two explanations

  (ii) Firm Collateral Channel

$$\#\text{ CRE prices} \quad ! \quad \#\text{ collateral value} \quad ! \quad \#\text{ loans (constrained firms)} \quad \#\text{ firms's labor demand}$$

Go to Road Map

Motivation

- Drop in real estate prices associated with employment declines

  # real estate price ! # employment

- Two explanations
  - (i) Housing Wealth Channel
  - (ii) Firm Collateral Channel
- Importance of (i) & (ii) channel $\Longrightarrow$ different policy implications

  Example: 2007 US housing crash
- Understanding relative dominance $\Longrightarrow$ provide better policy guidance

Go to Road Map

This Paper

- **Research Question**

  Decrease in residential + CRE prices) a decline in labor

  Relative importance of Housing wealth & Firm collateral channel?

- **Main challenges**

  (1) Separate both channels affecting labor demand

  Positive correlation residential and CRE prices

  (2) Tease out other mechanisms unrelated to the two channels of interest

  Other mechanisms a ect labor market after drop in real estate prices (i.e labor supply)

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- To address (1) & (2) this paper combines

) Reduced form evidence + Quantitative Model

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  Decrease in residential + CRE prices ⇒ a decline in labor

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- **Main challenges**

  (1) Separate both channels

- To address (1)

  ⇒ Reduced form evidence

  Use 2012 Property Tax Reform in Italy ⇒ estimate effect " property taxes

  ? " property tax for houses=CRE ⇒ speci c shock ⇒ # residential=CRE price

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  Relative importance of Housing wealth & Firm collateral channel?

- **Main challenges**

  (1) Separate both channels

- To address (1)

) Reduced form evidence

  Use 2012 Property Tax Reform in Italy =) estimate effect " property taxes

  DID specification =) Outcome variables

  - ? Employment
  - ? Consumption expenditure
  - ? Residential and CRE prices

Go to Road Map

This Paper

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- **Main challenges**

  (1) Separate both channels

- To address (1)

) Reduced form evidence

  Separate both channels but don't provide a direct measure

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This Paper

- **Research Question**

  Decrease in residential + CRE prices) a decline in labor

  Relative importance of Housing wealth & Firm collateral channel?

- **Main challenges**

  (2) Tease out other mechanisms

- To address (2)

) Quantitative Model

  Financial frictions + housing & CRE + differential property taxes

  In model both channels induced by exogenous " property taxes

Go to Road Map

This Paper

- **Research Question**

  Decrease in residential + CRE prices) a decline in labor

  Relative importance of Housing wealth & Firm collateral channel?

- **Main challenges**

  (2) Tease out other mechanisms

- To address (2)

) Quantitative Model

  Discipline model with estimates obtained with Italian data

  Measure Housing wealth & Firm collateral channel

Go to Road Map

What I find?

(1) Empirical findings

- property tax rate for houses/CRE:
  - ? # Consumption expenditure
  - ? # Residential & CRE prices
  - ? # Non-tradable employment

Go to Road Map

What I find?

(2) Quantitative findings

Model does a good job matching reduced form estimates with Italian data

$\Longrightarrow$ Target moments

- ? Consumption
- ? Residential prices
- ? CRE prices

$\Longrightarrow$ Non-target moments

- ? Non-tradable employment

Go to Road Map

What I find?

(2) Quantitative findings

Model does a good job matching reduced form estimates obtained with Italian data

$\Rightarrow$ Target moments

$\Rightarrow$ Non-target moments

Both channels explain more than 80% of labor decline $\Rightarrow$ # real estate prices

$\Rightarrow$ Induced " property taxes

Go to Road Map

Road Map

I. Empirical Analysis

II. Model

III. Calibration Strategy

IV. Measuring the Housing Wealth and Firm Collateral Channel

V. Conclusions and Future Work

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Empirical Analysis: Initial Thoughts

- Empirical analysis in this paper

  Estimate effect of " property taxes

  Using the 2012 property tax reform in Italy

- Two questions I need to address

  1. **Why property taxes are relevant?**
  2. **Why focus on the Italian economy?**

Empirical Analysis: Why Property Taxes?

1. **Why property taxes are relevant?**

   Property tax changes , exogenous shock

   " Property taxes $\Rightarrow$ " cost acquire & hold real estate assets $\Rightarrow$ # demand $\Rightarrow$ # price

   Differential increase house & CRE property taxes

   $\Rightarrow$ specific shock to residential & CRE prices

   All else constant

   " house-owners tax rate $\Rightarrow$ # residential price $\Rightarrow$! hous. wealth

   " CRE-owners tax rate $\Rightarrow$ # CRE price $\Rightarrow$! firm collateral

   } # Labor demand

Empirical Analysis: Why Property Taxes?

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   " CRE-owners tax rate $\Rightarrow$ # CRE price $\overset{!}{\underset{\text{firm collateral}}{}}$

   $\Big\}$ # Labor demand

Empirical Analysis: Why Italy?

2. **Why focus on the Italian economy?**

   Italian economy provides a suitable environment due to three reasons

Go to Road Map

Empirical Analysis: Why Italy?

2. **Why focus on the Italian economy?**

   (i) Differential property taxes to house-owners & CRE-owners

   Principal (*prin*) =) t^h

   House-owners) if used as main residence

   Secondary (*sec*) =) t^f

   Other properties) Firms that own CRE

Go to Road Map

Empirical Analysis: Why Italy?

2. **Why focus on the Italian economy?**

   (i) Differential property taxes to house-owners & CRE-owners

   (ii) Property taxes defined independently by municipalities each year

   " or # t^h & t^f within range determined by central government

Go to Road Map

Empirical Analysis: Why Italy?

2. **Why focus on the Italian economy?**

   (i) Differential property taxes to house-owners & CRE-owners

   (ii) Property taxes defined independently by municipalities each year

   (iii) 2012 Property Tax Reform

   $=)$ imposed by central government

   $=)$ force municipalities " t^h & t^f

Go to Road Map

Italian Property Tax Reform: Results

I Main consequences of 2012 Property Tax Reform

(1) Sharp increase in t^h & t^f: Details

(2) Large variation across municipalities: Details

Go to Road Map

Italian Property Tax Reform: Results

- Main consequences of 2012 Property Tax Reform
  - (1) Sharp increase in t^h & t^f: Details
  - (2) Large variation across municipalities: Details
- Basic idea for empirical strategy) exploit

  Differential increase in t^h & t^f

  Significant variation across municipalities
- **Next step**

  Define main variables =) municipal level data

  Parametric specification

Go to Road Map

Data

- **Notation**: $m;t$ = municipality, year
- Municipal level data
  - Balance panel
  - 6,220 municipalities
  - Period 2008-2014

Data

- Variables of interest
  1. Property tax rate (t^h, t^f)
  2. Employment (L)
  3. Consumption Expenditure (C)
  4. Real Estate Prices (P^h;P^f)

Go to Road Map | Jump to Specification | Representativeness
Stat: Main Var | Stat: Add Var | TNT def | Non-Trad | Trad | P^h & P^f | C

Data

- Variables of interest
  1. Property tax rate (t^h, t^f)

     From o cial acts issued each year by municipalities
  2. Employment (L)
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Data

- Variables of interest
  1. Property tax rate (t^h, t^f)
  2. Employment (L)

     Based on census on establishments across Italy

     Number of employees working in establishments located in municipality

     Focus =) Non-Tradable sector

     Exclude =) Construction sector
  3. Consumption Expenditure (C)
  4. Real Estate Prices (P^h;P^f)

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Data

- Variables of interest
  1. Property tax rate (t^h, t^f)
  2. Employment (L)
  3. Consumption Expenditure (C)

     Proxy =) new vehicles household expenditure
  4. Real Estate Prices (P^h;P^f)

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Data

- Variables of interest
  1. Property tax rate (t^h, t^f)
  2. Employment (L)
  3. Consumption Expenditure (C)
  4. Real Estate Prices (P^h;P^f)

     Houses) Residential properties

     Commercial real estate) Retail stores properties

Go to Road Map | Jump to Specification | Representativeness
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Specification: Two-way Fixed Effect Model

I **Notation:**

$Y_{m;t}$: outcome variable $) \quad Y = \{L; C; P^h; P^f\}$

$y_{m;t} = \frac{Y_{m;t} \quad Y_{m;t \ 1}}{(Y_{m;t} + Y_{m;t \ 1})/2} \quad) \quad y = \{l; c; p^h; p^f\}$

$\Delta t^i_{m;t} = t^i_{m;t} \quad t^i_{m;t \ 1}$ for $i = fh; f\,g$

? Principal tax rate (*prin*): t^h $=)$ House-ownwers

? Secondary tax rate (*sec*): t^f $=)$ Firms owning CRE

Specification: Two-way Fixed Effect Model

- Baseline specification $\Rightarrow$ Diff-in-Diff

$$y_{m;t} = d_m + d_t + b_{y;h}\ \Delta t^{h}_{m;t} \quad 1ft = 2012g + b_{y;f}\ \Delta t^{f}_{m;t} \quad 1ft = 2012g + e_{m;t}$$

d_m: Municipality FE

d_t: Year FE

$e_{m;t}$ $\Rightarrow$ unobserved trend components

Covariance matrix $e_{m;t}$

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

Specification: Two-way Fixed Effect Model

- Baseline specification) Diff-in-Diff

$$y_{m;t} = d_m + d_t + b_{y;h}\ \Delta t^h_{m;t} \quad \mathbb{1}ft = 2012g + b_{y;f}\ \Delta t^f_{m;t} \quad \mathbb{1}ft = 2012g + e_{m;t}$$

- Coefficients of interest) $b_{y;h}$ & $b_{y;f}$

$\Delta t^i_{m;t}$ $\mathbb{1}ft = 2012g =$ Treatment Intensity Post-Tax Reform

- Interpreting $b_{y;i}$

1 pp. Δt^i higher =) change y by $b_{y;i}$ pp.

$b_{y;i}$) elasticity of y to t^i

Estimation Results

- Baseline specification results

		Employment	Consumption	Real Estate Prices	
		Non-Tradables	Durables	Houses	CRE
		$\hat{b}_{l;i}$	$\hat{b}_{c;i}$	$\hat{b}_{p^h;i}$	$\hat{b}_{p^f;i}$
$\Delta t^h_{m;t}$	$1\{ft = 2012\}$	-0.087***	-0.517***	-0.022**	-0.005
		(0.015)	(0.145)	(0.009)	(0.010)
$\Delta t^f_{m;t}$	$1\{ft = 2012\}$	-0.045***	-0.177	-0.017***	-0.032***
		(0.011)	(0.120)	(0.006)	(0.008)

Go to Road Map | Stat: Main Var | Identification | Parallel Trends: Implementation | Model

Estimation Results

I Baseline specification results

" t^h, t^f =) # I^{nt}

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" $t^h =)$ # c

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Estimation Results

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Estimation Results

- Baseline specification results $=)$ robust to changes
  - Different growth rate definition
  - Selected sample
  - Alternative Specifications: Details

		Employment	Consumption	Real Estate Prices	
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Identification: About Parallel Trends

- Identification with Diff-in-Diff

  Parallel trends in outcome

  $\Longrightarrow$ If no treatment on treated groups

- For the case of the 2012 tax reform

  Across different $(\Delta t^h; \Delta t^f)$ choices

  In the absence of tax rate changes

  $\Longrightarrow$ outcome trends behave similarly

Parallel Trends: Empirical Implementation

- Most used approach) Event study analysis
- **Implementation**:

$$y_{m;t} = d_m + d_t + \sum_{\tilde{t}\neq 2011} b^{\tilde{t}}_{y;h} 1\{t=\tilde{t}\} \quad \Delta t^{h}_{m;2012} + \sum_{\tilde{t}\neq 2011} b^{\tilde{t}}_{y;f} 1\{t=\tilde{t}\} \quad \Delta t^{f}_{m;2012} + e_{m;t}$$

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- $b^{\tilde{t}}_{y;i} =$⟩ Dynamic effect of 2012 tax reform

Parallel Trends: Empirical Implementation

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- $b^{\tilde{t}}_{y;i}$ ⟹ Dynamic effect of 2012 tax reform

  Lead coefficients ⟹ Pre-tax reform trend differences

  - ? $b^{2008}_{y;i}$ $b^{2009}_{y;i}$ $b^{2010}_{y;i}$
  - ? Base year 2011 ⟹ $b^{2011}_{y;i} = 1$

Parallel Trends: Empirical Implementation

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- **Implementation**:

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- $b^{\tilde{t}}_{y;i} =$⟩ Dynamic effect of 2012 tax reform

  Lag coefficients ⟹ Post-tax reform persistance effects

  ? $b^{2013}_{y;i}$ $b^{2004}_{y;i}$

Parallel Trends: Empirical Implementation

- Most used approach) Event study analysis
- **Implementation**:

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- $b^{\tilde{t}}_{y;i}$ =) Dynamic effect of 2012 tax reform

  Contemporaneous effect) relative to 2011

  ? $b^{2012}_{y;i}$) Di -in-Di estimate

Parallel Trends: Empirical Implementation

- Most used approach) Event study analysis
- **Implementation**:

$$y_{m;t} = d_m + d_t + \sum_{\tilde{t} \neq 2011} b^{\tilde{t}}_{y;h} 1\{t = \tilde{t}\} \quad \Delta t^{h}_{m;2012} + \sum_{\tilde{t} \neq 2011} b^{\tilde{t}}_{y;f} 1\{t = \tilde{t}\} \quad \Delta t^{f}_{m;2012} + e_{m;t}$$

- Testing for parallel trends

  Use lead coefficients

$$H_o : \; b^{2008}_{y;i} = b^{2009}_{y;i} = b^{2010}_{y;i} = 0$$

Parallel Trends: Empirical Implementation

- Most used approach) Event study analysis
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- Testing for parallel trends

  Use lead coefficients

$$H_o: \; b^{2008}_{y;i} = b^{2009}_{y;i} = b^{2010}_{y;i} = 0$$

- Results even study analysis:) No evidence of systematic trend differences

  For Δt^h: Results

  For Δt^f: Results

Go to Road Map | Identification | Identification: Add | Estimation Results | Model

Road Map

I. Empirical Analysis

II. Model

III. Calibration Strategy

IV. Measuring the Housing Wealth and Firm Collateral Channel

V. Conclusions and Future Work

Model Setup

- Closed economy, one period
- Continuum of firms produce differentiated goods
- Two type of real estate properties

  Houses H^h) households

  CRE H^f) firms
- Real estate used as collateral

  Loans paid within period) $R = 0$
- Dual property tax rate set by government

  t^h) Houses

  t^f) CRE

Demand Side: Households

I First Stage Problem) Housing/Non-housing Expenditure & Labor Supply

$$\begin{aligned} \max_{\{C;L;H^h\}} \quad & C^b (H^h)^{1\ b} \quad \frac{c}{1+\frac{1}{n}} L^{1+\frac{1}{n}} \\ \text{subject to} \quad & C + P^h H^h \left(1 + t^h\right) = W L + \Pi \\ & C \quad f_h\ P^h H^h \end{aligned}$$

$W\ L$: Labor Income

Π: Aggregate profits from firms

t^h: Tax rate house-owners

I Parameters :

(1) b =) Expenditure share on consumption goods

(2) n =) Frisch elasticity labor supply

(3) f_h =) Loan-to-Value ratio households

Go to Road Map

Demand Side: Households

I Second Stage Problem) Consumption demand for varieties

$$\min_{(c_j)_{j2[0;1]}} \int_0^1 p_j c_j dj$$

$$\text{subject to} \quad C \quad \left(\int_0^1 c_j^{1 \ \frac{1}{e}} dj \right)^{\frac{1}{1 \ \frac{1}{e}}}$$

All prices expressed in units of C) $P_C = 1$

I Parameters :

(4) e =) Elasticity of demand for variety j

Go to Road Map

Production Side: Goods

- Goods Producing Sector : Firm producing variety j

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

$$\text{s.t} \quad c_j = L^a (H^f)^{1 \ a}$$

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

$$W L_j \quad f_f \ P^f H_j^f$$

Π_j : Profits net of property taxes

t^f : Property tax for firms

- Parameters :

(5) a $=)$ Labor share

(6) f_f $=)$ Loan-to-Value ratio for firms

Go to Road Map

Housing and CRE Supply

- Construction sector
- Represented by exogenous supply functions

$$H^h(P^h) = (P^h)^{s_h}$$

$$H^f(P^f) = (P^f)^{s_f}$$

- Parameters :
  - (7) s_h =) Housing supply elasticity
  - (8) s_f =) CRE supply elasticity

Go to Road Map

Equilibrium with Binding Constraints

- Two advantages of using simple model
  1. Model's (constrained) equilibrium $\Rightarrow$ closed form solution

     Given $= [b; n; a; e; f_h; f_f; s_h; s_f]$

     Solve for:

     Allocations $= \Rightarrow L(\ ; t^h; t^f); C(\ ; t^h; t^f)$

     Prices $= \Rightarrow P^h(\ ; t^h; t^f); P^f(\ ; t^h; t^f)$

  2. Close form solution for L, C, P^h and $P^h = \Rightarrow$ Log-linear in t^f & t^h

     Effect of property tax reform in the model?

     Compare Log-linear equilibrium for two tax regimes $= \Rightarrow$ High/Low

Go to Road Map

Equilibrium definition | Binding borrowing constraints | Log-linear solution

Effect of a Property Taxes Reform

- Property tax reform $\Longrightarrow$ increase property taxes

$$(t_0^h; t_0^f) \;\&\; (t_1^h; t_1^f) \Longrightarrow \; t_1^i > t_0^i \;, i = fh; fg$$

- Equilibrium response:

$$Y = \left\{L; C; P^h; P^f\right\}$$

$$\Longrightarrow \begin{cases} Y_0(\Theta; t_0^h; t_0^f) \\ Y_1(\Theta; t_1^h; t_1^f) \end{cases}$$

Effect of a Property Tax Reform

I Equilibrium solution Log-linear in t^f & t^h

$$y = \log(Y_1) \quad \log(Y_0) =) \; y = \{I; c; p^h; p^f\}$$

$$\Delta t^i = t_1^i \quad t_0^i =) \; i = fh; fg$$

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

Effect of a Property Tax Reform

I Equilibrium solution Log-linear in t^f & t^h

$y = \log(Y_1) \quad \log(Y_0) =) \; y = \{I; c; p^h; p^f\}$

$\Delta t^i = t_1^i \quad t_0^i =) \; i = fh; fg$

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

Model reduced form effect $=) \; b_{y;i}(\Theta) = \frac{\P y}{\P \Delta t^i}$

Go to Road Map | Reduced Form Effect: Main Result

Effect of a Property Tax Reform

- Equilibrium solution Log-linear in t^f & t^h

  $y = \log(Y_1) \quad \log(Y_0) =) \; y = \{I; c; p^h; p^f\}$

  $\Delta t^i = t_1^i \quad t_0^i =) \; i = fh; fg$

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

  Model reduced form effect $=) \; b_{y;i}(\Theta) = \frac{\P y}{\P \Delta t^i}$

- **Model** & **empirical strategy** similar functional form

  Empirical estimates $\widehat{b_{y;i}} =)$ discipline the model's $b_{y;i}(\Theta)$

- Before going to calibration strategy

  Housing wealth & Firm collateral channel induced by " property taxes ?

Go to Road Map Reduced Form Effect: Main Result

Reduced Form Effect Employment: Decomposition

- In the model

  Δt^h & Δt^f) equilibrium employment

- Part of equilibrium response in labor market explained by

  housing wealth & firm collateral effect

- Equilibrium response of employment to tax reform

$$\Delta l = b_{l;h}(\Theta)\,\Delta t^h + b_{l;f}(\Theta)\,\Delta t^f; \quad \Delta l = \log(L_1) - \log(L_0)$$

Reduced Form Effect Employment: Decomposition

- Equilibrium response of employment to tax reform

$$I = b_{I;h}(\Theta)\,\Delta t^h + b_{I;f}(\Theta)\,\Delta t^f$$

- **Main Decomposition Result**:

$$b_{I;h}(\Theta) = d^{\text{wealth}}(\Theta) + d_h^W + d_h^{P^f}$$

$$d^{\text{wealth}}(\Theta) = \frac{\P I}{\P \Delta t^h} = \frac{\P I^d}{\P c}\,\frac{\P c}{\P p^h}\,\frac{\P p^h}{\P \Delta t^h}$$

$d_h^W + d_h^{P^f}$ =) GE adjustments due to " t^h

Reduced Form Effect Employment: Decomposition

- Equilibrium response of employment to tax reform

$$I = b_{I;h}(\Theta)\,\Delta t^h + b_{I;f}(\Theta)\,\Delta t^f$$

- **Main Decomposition Result**:

$$b_{I;f}(\Theta) = d^{\text{coll}}(\Theta) + d_f^W + d_f^{P^h}$$

$d^{\text{coll}}(\Theta) = \frac{\P I}{\P \Delta t^f} = \frac{\P I^d}{\P p^f}\frac{\P p^f}{\P \Delta t^f}$

$d_f^W + d_f^{P^h}$ =) GE adjustments due to " t^f

Reduced Form Effect Employment: Decomposition

- Equilibrium response of employment to tax reform

$$l \;=\; b_{l;h}(\Theta)\;\Delta t^{h} \;+\; b_{l;f}(\Theta)\;\Delta t^{f}$$

- **Main Decomposition Result**:

$$b_{l;f}(\Theta) = d^{\text{coll}}(\Theta) + d_f^{W} + d_f^{P^h}$$

$$b_{l;h}(\Theta) = d^{\text{wealth}}(\Theta) + d_h^{W} + d_h^{P^f}$$

- d^{coll} & d^{wealth} depend (s_h, s_f) & (f_h, f_f)

$$d^{\text{wealth}}(\Theta) = \left(\frac{1+n}{1+f_h}\right)\left(\frac{1+s_h}{1+s_h+(1 \quad b)n}\right)$$

$$d^{\text{coll}}(\Theta) = \left(\frac{e}{1+f_f}\right)\left(\frac{1+s_f}{1+s_f+(1 \quad a)(e \quad 1)}\right)$$

Decomposition Result: Details | Intuition

Road Map

I. Empirical Analysis

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Calibration Procedure

- Closed form expression for both channels

$$d^{\text{wealth}}(\Theta) = \left(\frac{1+n}{1+f_h}\right)\left(\frac{1+s_h}{1+s_h+(1 \quad b)n}\right)$$

$$d^{\text{coll}}(\Theta) = \left(\frac{e}{1+f_f}\right)\left(\frac{1+s_f}{1+s_f+(1 \quad a)(e \quad 1)}\right)$$

- Parameters calibrated internally $=)$ $\Theta_{\text{in}} = [f_h; f_f; s_h; s_f]$

  s_f s_h $)$ Supply elasticity for houses and CRE

  f_h f_f $)$ LTV-ratio for hh's and firms

- Parameters set externally $=)$ $\Theta_{\text{out}} = [a; e; n; b]$

Calibration Procedure

I Idea) is to calibrate $\Theta_{in} = [f_h; f_f; s_h; s_f] =)$ target $\left\{\hat{b}_{y;h}, \hat{b}_{y;f}\right\}$

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

Calibration Procedure

I Won't target $\hat{b}_{l;h}$, $\hat{b}_{l;f}$ $=)$ Model validation test

Compare $b_{l;h}(\Theta)$, $b_{l;f}(\Theta)$ to $\hat{b}_{l;h}$, $\hat{b}_{l;f}$

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

Calibration Procedure

I Exclude $\hat{b}_{c;f}$, $\hat{b}_{p^f;h} =)$ Non-statistically significant

$$\underbrace{\begin{bmatrix} \hat{b}_{c;h} & \hat{b}_{c;f} \\ \hat{b}_{p^h;h} & \hat{b}_{p^h;f} \\ \hat{b}_{p^f;h} & \hat{b}_{p^f;f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} b_{c;h}(\Theta) & b_{c;f}(\Theta) \\ b_{p^h;h}(\Theta) & b_{p^h;f}(\Theta) \\ b_{p^f;h}(\Theta) & b_{p^f;f}(\Theta) \end{bmatrix}}_{\text{MODEL}}$$

Calibration Procedure

I Target moments

$=)\ \hat{b}_{c;h},\ \hat{b}_{p^h;h},\ \hat{b}_{p^h;f},\ \hat{b}_{p^f;f}$

$$\underbrace{\begin{bmatrix} \hat{b}_{c;h} & \hat{b}_{c;f} \\ \hat{b}_{p^h;h} & \hat{b}_{p^h;f} \\ \hat{b}_{p^f;h} & \hat{b}_{p^f;f} \end{bmatrix}}_{\text{DATA}} = \underbrace{\begin{bmatrix} b_{c;h}(\Theta_{out}; f_h) & b_{c;f}(\Theta) \\ b_{p^h;h}(\Theta_{out}; s_h) & b_{p^h;f}(\Theta_{out}; f_f) \\ b_{p^f;h}(\Theta) & b_{p^f;f}(\Theta_{out}; s_f) \end{bmatrix}}_{\text{MODEL}}$$

(1) $\hat{b}_{c;h} =)\ f_h$

(2) $\hat{b}_{p^h;f} =)\ f_f$

(3) $\hat{b}_{p^h;h} =)\ s_h$

(4) $\hat{b}_{p^f;f} =)\ s_f$

Calibration Results

I External set parameters $=)$ $\Theta_{out} = [t^h; t^f; a; b; e]$

	Parameter	Value	Target
Labor Share	a	0.6	Labor Share Italy
Frisch elasticity	n	1	Common in literature
Elasticity of demand	e	4	Bai et. al (2020)
Exp. share goods	b	0.8	Berger et. al (2018)

Calibration Results

- Internal calibration $\Rightarrow$ $\Theta_{in} = [f_h; f_f; s_h; s_f]$

	Parameter	Value	Target
Supply elast. houses	s_h	4.87	$\hat{b}_{p^h;h}$
Supply elast. CRE	s_f	2.40	$\hat{b}_{p^f;f}$
LTV HH's	f_h	0.23	$\hat{b}_{c;f}$
LTV firms	f_f	0.35	$\hat{b}_{p^h;f}$

- Calibration is consistent with similar estimates in the literature

Go to Road Map | Back to Intro Calibration
External Parameters | Comparing Calibration | Calibration Procedure | Validation Test | Decomposition Results

Checking Model's Predictions: $b_{l;i}$ vs $\hat{b}_{l;i}$

- Model predictions validation test

  Compare $b_{l;h}$, $b_{l;f}$ with $\hat{b}_{l;h}$, $\hat{b}_{l;f}$

	Model	Data	
	$b_{L;i}$	$\hat{b}_{L;i}$	95% CI
Δt^h	0.074	0.087	[0.06, 0.12]
Δt^f	0.061	0.045	[0.02, 0.07]

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  $b_{l;h}$) underpredicts $\hat{b}_{l;h}$

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Checking Model's Predictions: $b_{l;i}$ vs $\hat{b}_{l;i}$

- Model does a fairly good job replicating empirical estimates for labor

  $b_{l;h}$ and $b_{l;h}$ $=)$ *2* 95% CI

	Model	Data	
	$b_{L;i}$	$\hat{b}_{L;i}$	95% CI
Δt^h	0.074	0.087	[0.06, 0.12]
Δt^f	0.061	0.045	[0.02, 0.07]

Road Map

I. Empirical Analysis

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Decomposition Results: Housing Wealth & Firm Collateral Channel

I Decomposition Result

$$b_{l;h}(\Theta) = d^{\text{wealth}}(\Theta) + d_h^W + d_h^{P^f}$$

$$b_{l;f}(\Theta) = d^{\text{coll}}(\Theta) + d_f^W + d_f^{P^h}$$

Housing wealth channel

" Δt^h 1 pp =) 0.074 pp = $\underbrace{0.073 \text{ pp}}_{98\ \%}$ + 0.001 pp

Firm collateral channel

" Δt^f 1 pp =) 0.061 pp = $\underbrace{0.052 \text{ pp}}_{84\ \%}$ + 0.009 pp

Road Map

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To Conclude...

- Relative importance firm collateral and housing wealth channel?

  During episode of # house prices and # employment

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  - Separate both channels difficult
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To Conclude...

- Relative importance firm collateral and housing wealth channel?
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  - Need to tease out other mechanisms
- I provide a unifying approach to model and quantify both channels
  - Reduced form estimates) 2012 Italian property tax reform
  - Build a GE model) measure both channels

To Conclude...

- Relative importance firm collateral and housing wealth channel?
- Previous work focus single channel
  - Separate both channels difficult
  - Need to tease out other mechanisms
- I provide a unifying approach to model and quantify both channels
  - Reduced form estimates $\Rightarrow$ 2012 Italian property tax reform
  - Build a GE model $\Rightarrow$ measure both channels
  - Discipline the model to replicate empirical estimates

To Conclude...

- Relative importance firm collateral and housing wealth channel?
- Previous work focus single channel
  - Separate both channels difficult
  - Need to tease out other mechanisms
- I provide a unifying approach to model and quantify both channels
  - Reduced form estimates) 2012 Italian property tax reform
  - Build a GE model) measure both channels
  - Discipline the model to replicate empirical estimates
- Firm collateral channel as important as important housing wealth channel

) Explain more than 80% of employment drop after decline in real estate prices

Decline in real estate prices induced by higher property taxes

Future Work

- Using the same tax reform $\Rightarrow$ firm level estimates
  - (i) How assets value and borrowing levels are changing?
- Model improvements
  - (i) Dynamics
  - (ii) Trade $\Rightarrow$ why tradable employment is not affected?
  - (iii) What about migration?

THANK YOU !

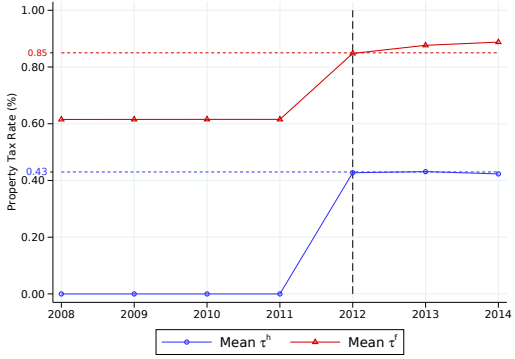
(1) Increase in t^h & t^f

- Average change tax rate:

  $\Delta t^h_{2012} = 0{:}43$ 322 euros

  $\Delta t^f_{2012} = 0{:}85$ 200 euros

- Unique event not observed before of after 2012.

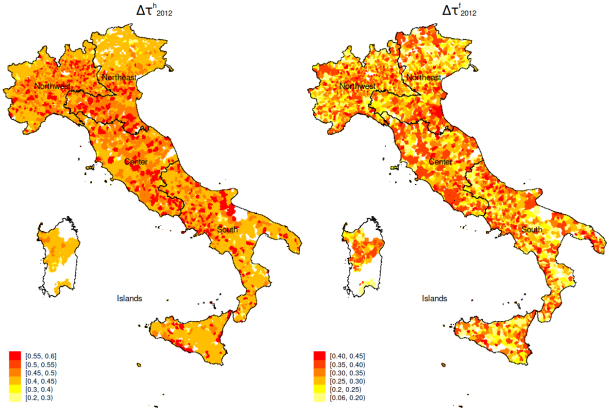


Back Tax Reform Results

(2) Large Variation in t^h & t^f

- Off-tax reform years) Δt^h & Δt^f 0 across municipalities

$$Var(\Delta t^i_{2012}) \quad 5 \quad Var(\Delta t^i_{t6=2012}) \; i = fh; fg$$



Back Tax Reform Results

About Sample Representativeness

- Sample of 6,220 municipalities

  $=)$ representative for whole Italian economy

- For 2012:

  (1) 77:75% of total municipalities (8;000)

  (2) 88% total population

  (3) 89:5% total employment

  (4) 93% total income

Back to Data Back to Variables

Tradables and Non-Tradables Definition

- Following Mian and Sufi (2012).
- ? 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 Back to Data

Tradables and Non-Tradables Definition

- Let s be a 2-Digit (NACE Rev.2) industry code.
- I use 2007 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 Back to Data

Tradables and Non-Tradables Definition

- Procedure:

1. If $X_s + M_s > 0$:

$$\text{Trade}_s^E > \text{Trade}_{\text{Median}}^E \text{ or } \text{Trade}_s^Y > \text{Trade}_{\text{Median}}^Y \;) \;\; s \; 2 \text{ Tradable}$$

2. If $X_s + M_s > 0$ and 1. is not satisfied:

$$HHI_s > HHI_{\text{P75}^{\text{th}}} \;) \;\; s \; 2 \text{ Tradable}$$

3. If $X_s + M_s = 0$:

$$HHI_s > HHI_{\text{P75}^{\text{th}}} \;) \;\; s \; 2 \text{ Tradable}$$

$$HHI_s < HHI_{\text{P25}^{\text{th}}} \;) \;\; s \; 2 \text{ Non-Tradable}$$

- Thresholds:

$$\text{Trade}_{\text{Median}}^E = 56487 \;\&\; \text{Trade}_{\text{Median}}^Y = 0{:}16$$

$$HHI_{\text{P25}^{\text{th}}} = 0{:}0045 \;\&\; HHI_{\text{P75}^{\text{th}}} = 0{:}015$$

Non-Trad Trad Back to Data

Non-Tradable NACE Industries

- # 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 Back to Variables

Tradable NACE Industries: Part a

- # 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
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

Back to TNT def Back to Variables

Tradable NACE Industries: Part b

- # Tradable Industries = 28
- Mean **HHI** Tradables = 0:017

Division	Name	Section	Trade^{E}	Trade^{Y}	HHI
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 Back to Variables

Real State Prices: Real State Observatory (OMI)

- **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.

Back to Variables

Household Consumption on Vehicles

- Idea: Mian and Sufi (2013)

$$X_{m;t}^{\text{cars}} = w_{m;t} \; X_t^{\text{cars}}; \; w_{m;t} = \frac{P_{m;t}^{\text{Cars}} \; Q_{m;t}^{\text{Cars}}}{P_t^{\text{Cars}} \; Q_t^{\text{Cars}}}$$

- Assume:

$$\frac{P_{m;t}^{Cars}}{P_t^{\text{Cars}}} = p_m^{\text{cars}} \quad) \quad X_{m;t}^{\text{cars}} \; \mu \; w_{m;t}^{Q} \; X_t^{\text{cars}} = \frac{Q_{m;t}^{\text{Cars}}}{Q_t^{\text{Cars}}} \; X_t^{\text{cars}}$$

- Data new vehicles registrations 2009-2015

$$\hat{w}_{m;t}^{Q} = \frac{\text{New Cars Registered}_{m;t}}{\text{å}_m \text{ New Cars Registered}_{m;t}}$$

- Durable Expenditure proxy $C_{m;t}^{dur}$:

$$C_{m;t}^{dur} = \hat{w}_{m;t}^{Q} \; C_t^{\text{cars}}$$

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

Car definition Back to Variables

New Vehicle Registration Data

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

Back to *C* Back to Variables

Summary Statistics: Main 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
Δt^h	0.43	0.07	0.40	0.40	0.50
Δt^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

Back to Variables | Back to Specification | Back to Estimation Results

Summary Statistics: Local Government Finances

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

Back to Variables Back to Specification

Robustness Checks: Alternative Specifications

- Let $\widehat{y}_{m;t}^{\text{Baseline}}$:

$$\widehat{y}_{m;t}^{\text{Baseline}} = d_m + d_t + b_{y;h}\ \Delta t_{m;t}^{h} \quad \mathbf{1}\{t = 2012\} + b_{y;f}\ \Delta t_{m;t}^{f} \quad \mathbf{1}\{t = 2012\}$$

- Baseline specification:

$$y_{m;t} = \widehat{y}_{m;t}^{\text{Baseline}} + e_{m;t}^{0}$$

Back to Specification Back to Results

Robustness Checks: Alternative Specifications

- Baseline specification:

$$y_{m;t} = \widehat{y}^{\text{Baseline}}_{m;t} + e^{0}_{m;t}$$

- Controlling for municipal time varying covariates: $\mathbf{X}_{m;t\ \ 1}$

$$y_{m;t} = \widehat{y}^{\text{Baseline}}_{m;t} + \mathbf{X}_{m;t\ \ 1} + e^{1}_{m;t}$$

where $\mathbf{X}_{m;t\ \ 1}$ includes:

1. Local economic conditions
2. Supply Side Controls
3. Local Government Controls
4. Other Local Tax Policy Changes

Back to Specification | Back to Results
Back to Results | Stat: Main Var | Stat: Add Var | Local Eco | Supply Side | Local Gov | Local Tax Changes

Robustness Checks: Alternative Specifications

- Baseline specification:

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + e^{0}_{m;t}$$

- Controlling for municipal time varying covariates: $\mathbf{X}_{m;t\ \ 1}$

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + \mathbf{X}_{m;t\ \ 1} + e^{1}_{m;t}$$

- Controlling for unobservable local labor market trends: $d_{m2\text{LLS};t}$

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + d_{m2\text{LLS};t} + e^{2}_{m;t}$$

Local Labor Market (LLS):

Group of neighbor municipalities

Labor force lives and works

Establishments can find most of the labor force

$=)$ Commuting Zones

Back to Specification Back to Results

Robustness Checks: Alternative Specifications

- Baseline specification:

$$y_{m;t} = \hat{y}_{m;t}^{\text{Baseline}} + e_{m;t}^{0}$$

- Controlling for municipal time varying covariates: $\mathbf{X}_{m;t\ \ 1}$

$$y_{m;t} = \hat{y}_{m;t}^{\text{Baseline}} + \mathbf{X}_{m;t\ \ 1\ \ } + e_{m;t}^{1}$$

- Controlling for unobservable local labor market trends: $d_{m2\text{LLS};t}$

$$y_{m;t} = \hat{y}_{m;t}^{\text{Baseline}} + d_{m2\text{LLS};t} + e_{m;t}^{2}$$

- Testing additional mechanisms

  $=)$ Correlation between property tax changes and:

  (1) Productivity shocks

  (2) Credit supply shocks

  (3) Uncertainty shocks

Back to Specification | Back to Results
Productivity | Credit supply | Uncertainty

Robustness Checks: Alternative Specifications

- Testing additional mechanisms

  $=)$ Correlation between property tax changes and:

  (1) Productivity shocks: $z_{m;t\ \ 1}$

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + w^{z}_{y;h}\ \Delta t^{h}_{m;2012}\quad z_{m;t\ \ 1} + w^{z}_{y;f}\ \Delta t^{f}_{m;2012}\quad z_{m;t\ \ 1} + e^{3}_{m;t}$$

$Z_{m;t}$ = Real total income per employee (2010=100)

$$z_{m;t} = \frac{Z_{m;t}\quad Z_{m;t\ \ 1}}{(Z_{m;t} + Z_{m;t\ \ 1})=2}$$

Back to Specification | Back to Results | Back robustness main

Robustness Checks: Alternative Specifications

- Testing additional mechanisms

  $=)$ Correlation between property tax changes and:

  (2) Credit supply shocks: $\left(\frac{\text{Loan}}{\text{Deposits}}\right)_{m;t\ \ 1}$

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + w^{\text{loan}}_{y;h}\ \Delta t^{h}_{m;2012}\ \left(\frac{\text{Loan}}{\text{Deposits}}\right)_{m;t\ \ 1} + w^{\text{loan}}_{y;f}\ \Delta t^{f}_{m;2012}\ \left(\frac{\text{Loan}}{\text{Deposits}}\right)_{m;t\ \ 1} + e^{4}_{m;t}$$

Loans and Deposits of all bank branches within municipality

Back to Specification | Back to Results | Back robustness main

Robustness Checks: Alternative Specifications

I Testing additional mechanisms

$=)$ Correlation between property tax changes and:

(3) Uncertainty shocks: $s^{z}_{P;t\ \ 1}$

$$y_{m;t} = \hat{y}^{\text{Baseline}}_{m;t} + w^{\text{uncert}}_{y;h}\ \Delta t^{h}_{m;2012}\quad s^{z}_{P;t\ \ 1} + w^{\text{uncert}}_{y;f}\ \Delta t^{f}_{m;2012}\quad s^{z}_{P;t\ \ 1} + e^{5}_{m;t}$$

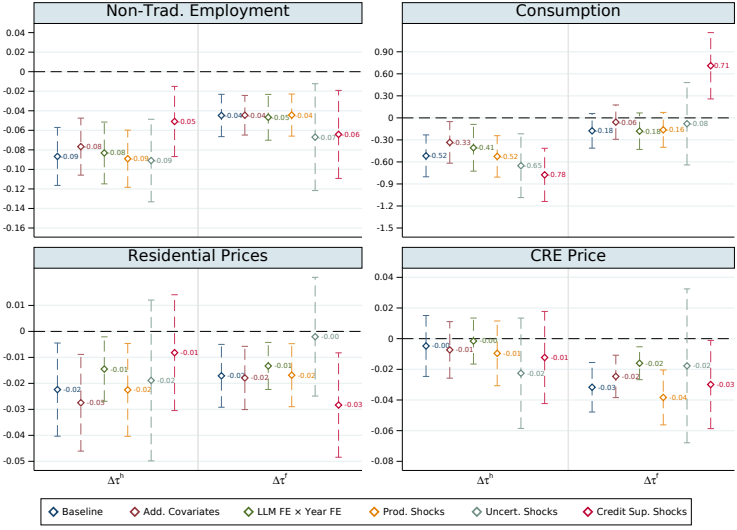
$s^{z}_{P;t\ \ 1}$: Sample standard deviation z across municipalities within province P

$$s^{z}_{P;t} = \sqrt{\frac{1}{N_{m2P}\quad 1}\sum_{m2p}\left[z_{m;t}\quad \bar{z}_{P;t}\right]^{2}}$$

$$\bar{z}_{P;t} = \frac{1}{N_{m2P}}\sum_{m2p} z_{m;t}$$

Back to Specification | Back to Results | Back robustness main

Robustness Checks: Results



Back to Results

Supply Side Controls

(1) Employment share 1-digit NACE Rev.2: For $j = fC;D;E;F;:::;R;Sg$.

$$\text{Share Employment}_{m;j} = \frac{E_{m;j}}{\mathring{a}_{j=C}^{S} E_{m;j}}$$

- 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.

Back to Alternative Specifications

Local economic conditions

(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:

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

Back to Alternative Specifications

Local Government Controls

(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.

Back to Alternative Specifications

Other Local Tax Policy Changes

(1) 2008 Exemption of Main Residence from households:

$$\mathbb{1}\{ft = 2008g\} \quad \Delta t^{prin}_{m;2008}$$

(2) 2011 Tax Income changes.

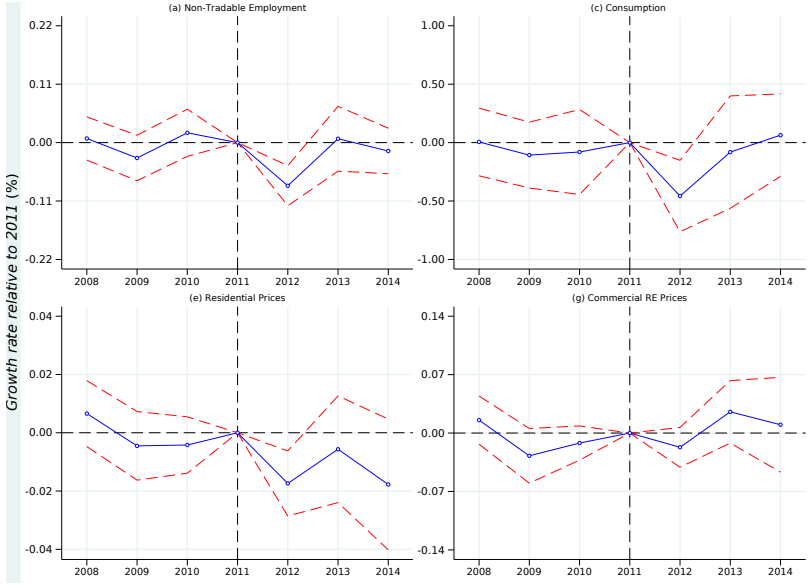
$$\mathbb{1}\{ft = 2011g\} \quad Ln\left(\frac{R_{m;\text{IRPEF}}}{\text{Population}_{m;2011}}\right)$$

(3) 2014 Property tax changes.

$$\mathbb{1}\{ft = 2014g\} \quad Ln\left(\frac{R_{m;\text{TASI}}}{\text{Population}_{m;2013}}\right)$$

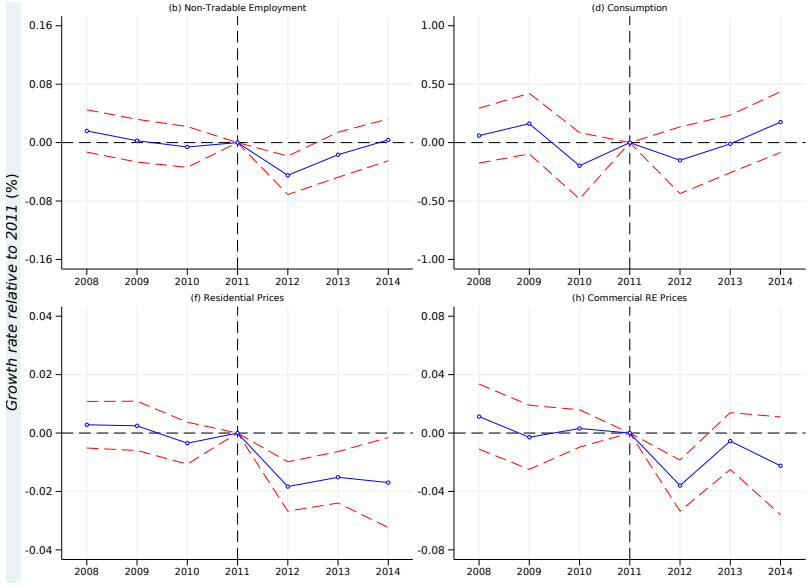
Back to Alternative Specifications

Even Study: Dynamic coefficients Δt^h



Back to Parallel Trends Back to Implementation

Even Study: Dynamic coefficients Δt^f



Back to to Parallel Trends | Back to Implementation

About No Anticipation

- Additional identification condition $\Rightarrow$ No anticipation effects

  No pre-treatment effects on outcome across treatment groups

- Municipalities don't anticipate tax reform

  No tax rate changes in advance

  No response of y before tax reform

- Seems to be a valid assumption

  $\Rightarrow$ Not likely given introduction of new tax system

  $\Rightarrow$ No changes in tax rates previous 2012

Back to Identification | Back to Implementation | Jump to Results
Timeline 1 | Timeline 2 | Tax Rate Changes
Event Study: Δt^h | Event Study: Δt^f

Italian Property Tax Reform: Timeline

- 1992-2010:

  Property tax system) "*Municipal tax on Properties*" (**ICI**)

  - ? $t^h; t^f$ 2 [0:4%; 0:7%]
  - ? House-owners) exempted ($t^h = 0$) if house
    House used main residence

    Not categorized as luxury property

  No major reforms to **ICI** system during 1992-2010

Back to No Anticipation

Italian Property Tax Reform: Timeline

- April 2011
  - $\Rightarrow$ "*Own Municipal Tax*" (**IMU**) replaced $\Leftarrow$ **ICI**
    - Higher lower & upper threshold for t^f
    - $\Leftarrow$ Increase t^f
    - No change to house-owners exemption
    - Introduction date **IMU** $\Leftarrow$ January 2014

Back to No Anticipation

Italian Property Tax Reform: Timeline

- November 2011

  Sovereign debt crisis episode) " spread Italian government bonds

  To reduce pressure of financial markets on Italian sovereign debt

  Central government push forward emergency fiscal package

  Fiscal adjustment relied mostly on property tax reform

  - Initial **IMU** transformed into *Experimental*-**IMU**

Back to No Anticipation

Italian Property Tax Reform: Timeline

- November 2011

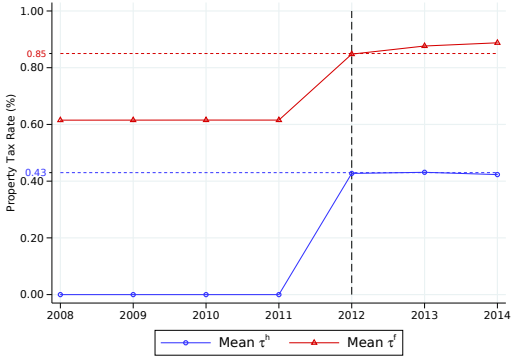
  Experimental-**IMU**

  - ? Increase in lower & upper threshold for t^f
  - ? Cancel exemption for house-owners main residence

) t^f t^h expected to increase
  - ? Introduction date **IMU**) January 2012

Back to No Anticipation

Average Tax Rate Increase in t^h & t^f



Back to No Anticipation

Competitive Equilibrium: Formal Definition

Definition (Competitive Equilibrium)

A competitive equilibrium in this economy is defined by

Prices $\{W; P^h; P^f; p_j\}$, allocations $\{L; H^h; H^f; C; c_j\}$

Shadow values $\{m^h; m^f\}$ and property tax rates $\{t^h; t^f\}$

Such that:

1. Given $\{W; P^h; P^f; p_j\}$ and $\{t^h; t^f\}$
   - 1.1 L, H^h and C solve 1st stage problem with m^h 0 and (c_j) solve 2nd stage problem.
   - 1.2 L and H^f maximize pro ts for rms with m^f 0.
   - 1.3 H^h and H^f are consistent with real estate supply functions.
2. Given a $\{L; H^h; H^f\}$ and $\{t^h; t^f\}$
   - 2.1 $\{W; P^f; P^h\}$ clear the markets for labor, houses and commercial real estate respectively.

Back to Equilibrium

Binding Borrowing Constraints

Proposition

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

Household's borrowing constraint binds (i.e. $m^h > 0$*) if and only if:*

$$\frac{C}{P^h H^h (1 + t^h)} < \frac{b}{1 \quad b}$$

Firm's collateral constraint will bind as well (i.e $m^f > 0$*) if and only if:*

$$\frac{WL}{P^f H^f (1 + t^f)} < \frac{a}{1 \quad a}$$

Back to Equilibrium

Log-Linear Equilibrium Solution

I Model's equilibrium) closed form solution

$$\log(L) = f_f + (1+s_f)\log(P^f) \quad \log(W) \tag{1}$$

$$\log(C) = f_h + (1+s_h)\log(P^h) \tag{2}$$

$$A_h \ \log(P^h) = k_{P^h}(\Theta) + (1+n)\Big[\log(W) \quad \log(1+t^h+f_h)\Big] + \log(1+t^f+e\,f_f) \tag{3}$$

$$A_f \log(P^f) = k_{P^f}(\Theta) + (1+s_h)\log(P^h) \quad a(e \quad 1)\log(W) \quad e\log(1+t^f+f_f) \tag{4}$$

(1)

$A_h = 1+s_h+(1 \quad b)n$

$A_f = 1+s_f+(1 \quad a)(e \quad 1)$

$k_{P^h}(\Theta)$, $k_{P^f}(\Theta)$, $k_W(\Theta)$

Back to Equilibrium

Effect of a Tax Reform in the Model

Proposition (Property Tax Reform: Reduced Form Effect)

Given Θ, if $\frac{t^h}{1+f_h}$, $\frac{t^f}{1+f_f}$ and $\frac{t^f}{1+e\,f_f}$ are small enough then the percentage change in $y = \{p^h; p^f; w; I; c\}$ after an increase in property taxes equal to Δt^h, Δt^f can be characterized as follows:

$$y \;=\; b_{y;h}(\Theta)\;\Delta t^h \;+\; b_{y;f}(\Theta)\;\Delta t^f\;; \tag{2}$$

where $\Delta t^i = t_1^i \quad t_0^i$ is the percentage point (pp.) change in i tax rate for $i = fh; f\,g$ and $b_{y;i}(\Theta)$ is the reduced form e ect of a change in t^i on y.

Back to Reduced Form Effect: Model

Housing Wealth & Firm Collateral Channel: Intuition

- Housing wealth channel

$$\uparrow t^h \underset{\#P^h}{\Rightarrow} \#L^d, \quad \text{all else constant}$$

$$\uparrow t^h \;\; ! \;\; \#H^{h;d} \;\; ! \;\; \#P^h \;\; ! \;\; \#f_h P^h H^h = C \;\; ! \;\; \#C \;\; ! \;\; \#L^d(C; P^f; W)$$

- Firm Collateral Channel

$$\uparrow t^f \underset{\#P^f}{\Rightarrow} \#L^d, \quad \text{all else constant}$$

$$\uparrow t^f \;\; ! \;\; \#H^{f;d} \;\; ! \;\; \#P^f \;\; ! \;\; \#f_f P^f H^f = W \;\; L^d \;\; ! \;\; \#L^d$$

Back to Decomposition

Decomposition Result: Details

Proposition (Decomposing the Employment Response)

Reduced form coe cients $b_{l;h}(\Theta)$ and $b_{l;f}(\Theta)$ can be decompose as follows:

$$b_{l;h} = d^{wealth}(\Theta) + \left[\frac{(1+s_h)(1+n)}{A_h} \quad (1+a(e \quad 1))\right] b_{w;h} \quad (1 \quad a)(e \quad 1) b_{p^f;h}$$

$$b_{l;f} = d^{coll}(\Theta) + \left[\frac{(1+s_f)a(e \quad 1)}{Af} \quad 1\right] b_{w;f} \quad \frac{(1+s_f)(1+s_h)}{A^f} b_{p^h;f}$$

where,

$$d^{wealth}(\Theta) = \left(\frac{1+n}{1+f_h}\right)\left(\frac{1+s_h}{1+s_h+(1 \quad b)n}\right)$$

$$d^{coll}(\Theta) = \left(\frac{e}{1+f_f}\right)\left(\frac{1+s_f}{1+s_f+(1 \quad a)(e \quad 1)}\right)$$

Back to decomposition

Calibration vs Literature

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

For hh's that own single home) 0:42

	Parameter	Value	Target
Supply elast. houses	s_h	4.87	$\hat{b}_{p^h;h}$
Supply elast. CRE	s_f	2.40	$\hat{b}_{p^f;f}$
LTV HH's	f_h	0.23	$\hat{b}_{c;f}$
LTV firms	f_f	0.35	$\hat{b}_{p^h;f}$

Back to Internal Calibration

Calibration vs Literature

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

  For hh's own CRE and don't rent it) 0:50

	Parameter	Value	Target
Supply elast. houses	s_h	4.87	$\hat{b}_{p^h;h}$
Supply elast. CRE	s_f	2.40	$\hat{b}_{p^f;f}$
LTV HH's	f_h	0.23	$\hat{b}_{c;f}$
LTV firms	f_f	0.35	$\hat{b}_{p^h;f}$

Back to Internal Calibration

Calibration vs Literature

- For s_h) benchmark Saiz (2010)

  Instrument $\Delta H^{h;d}$) industrial shares, migration and hours of sun

  Estimated value 16:67 (See TABLE III, column (4))

  Use data change in housing prices for 1970-2000

	Parameter	Value	Target
Supply elast. houses	s_h	4.87	$\hat{b}_{p^h;h}$
Supply elast. CRE	s_f	2.40	$\hat{b}_{p^f;f}$
LTV HH's	f_h	0.23	$\hat{b}_{c;f}$
LTV firms	f_f	0.35	$\hat{b}_{p^h;f}$

Back to Internal Calibration

Baseline Estimation Results

		Employment	Consumption	Real Estate Prices	
		Non-Tradables	Durables	Houses	CRE
		$\hat{b}_{l;i}$	$\hat{b}_{c;i}$	$\hat{b}_{p^h;i}$	$\hat{b}_{p^f;i}$
$\Delta t^h_{m;t}$	$1\{t = 2012\}$	-0.087***	-0.517***	-0.022**	-0.005
		(0.015)	(0.145)	(0.009)	(0.010)
$\Delta t^f_{m;t}$	$1\{t = 2012\}$	-0.045***	-0.177	-0.017***	-0.032***
		(0.011)	(0.120)	(0.006)	(0.008)

Back to Calibration Procedure