The Elasticity of Taxable Income in Spain: 1999-2014

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Outline

The Elasticity of Taxable Income (ETI)

- Impact of personal income taxes on individuals' economic decisions is a **key empirical question**
  - Important implications for **optimal tax policy design**
- Literature focuses on the elasticity of taxable income (ETI) with respect to the marginal tax rate because:
  - ETI captures both real and *reporting* responses to taxation
  - ETI is a sufficient statistic for revenue calculations (and welfare, under strict assumptions: Feldstein 1995, 1999)
- Basic formula:

$$\varepsilon \equiv \frac{\%\Delta \text{Taxable Income}}{\%\Delta(1 - \text{Marginal Tax Rate})} = \frac{\Delta \ln(z)}{\Delta \ln(1-\tau)} \qquad (1)$$

Income Tax Reforms in Spain and the ETI

- Spain is a very interesting country to study **responses to personal income taxation**
  - Multiple reforms that provide useful variation in marginal tax rates to **identify the ETI**
  - Implemented at different stages of the business cycle
- **3 Large Reforms** of the Spanish PIT in 1999-2014:
  1. 2003 Reform: tax cuts at the top and bottom of the income distribution
  2. 2007 Reform: redefinition of the tax bases (general vs savings) and changes in tax brackets
  3. 2012 Reform: tax increase at all income levels (larger at the top) + regional variation in tax schedules

This Paper

Provide consistent ETI estimates for Spain:

1. **Long period with multiple reforms**
   - Take together all the variation created by legislative changes
2. **Compute MTR for 4 sources of income**
   - Labor, Financial and Real-Estate Capital and Business
3. **Homogenization of the Tax Base**
   - Financial Capital Income and Personal Deduction
   - Exclude Capital Gains
4. **Panel 2SLS diff-in-diff Estimators**
   - Gruber and Saez (2002)
   - Kleven and Schultz (2014), Weber (2014), Doerrenberg et al. (2017)

Estimation Challenges

Estimation of the ETI poses several econometric challenges:

1. **Endogeneity**: changes in income (dep. var.) related to changes in marginal tax rates (expl. var.)
   - Positive income shock ⇒ Higher marginal tax rate
   - OLS estimates of the ETI are biased downwards
2. **Mean reversion**:
   - Income tends to revert to the mean (transitory income shocks disappear)
   - Bias has opposite signs for tax cuts vs tax increases
3. **Heterogeneous income trends**:
   - Non-tax-related trends may have different effect on taxpayers affected by reform vs those not affected
   - Typical example: increase in inequality since 1980s in the US
   - Spain: not secular trends but effect of Great Recession?

Summary of Results

1. ETI $\in (0.35, 0.8)$ for the 1999-2014 period
   - **Baseline estimates** $\in (0.55, 0.65)$
2. **Higher elasticity for self-employed** $\varepsilon \in (0.6, 1.4)$ compared to wage employees $\varepsilon \in (0.2, 0.45)$
3. **Elasticity of broad income** (EBI) $\in (0.1, 0.25)$
   - Suggests that most of the ETI response is due to avoidance, but also significant real and evasion responses
4. **Results robust to alternative specifications**, 1-2-3-year differences, and sample restrictions

Related Literature

There is a massive literature on this topic:

- **Surveys**: Slemrod (1998), Saez et al. (2012), Neisser (2017)
- **US studies**: Feldstein (1995, 1999), Moffitt & Wilhelm (1998), Auten & Carroll (1999), Goolsbee (2000), Gruber & Saez (2002), Saez (2003), Kopczuk (2003, 2005), Weber (2014)
- **Spain**: Sanmartin (2007), Diaz-Caro and Onrubia (2015), Sanz et al. (2016) Esteller-More & Foremny (2016)
- **Other EU countries**: Brewer et al. (2010), Kleven & Schultz (2014), Doerrenberg et al. (2017)
- **Alternative estimation methods**: top share analysis (Saez, Slemrod and Giertz 2012); cross-country regressions (Klemm et al. 2018); narrative approach (Mertens & Montiel-Olea 2018)

Outline

Data

We use the panel dataset of personal income tax returns (IRPF) for years 1999-2014 provided by the *Instituto de Estudios Fiscales*

- Random sample with 3% of all income tax returns; stratified by income, region and main income source (labor vs other)
- About 500,000 obs per year; 8.1 million in total
- Contains all relevant information about income sources, deductions, exemptions, etc.

The Spanish Personal Income Tax

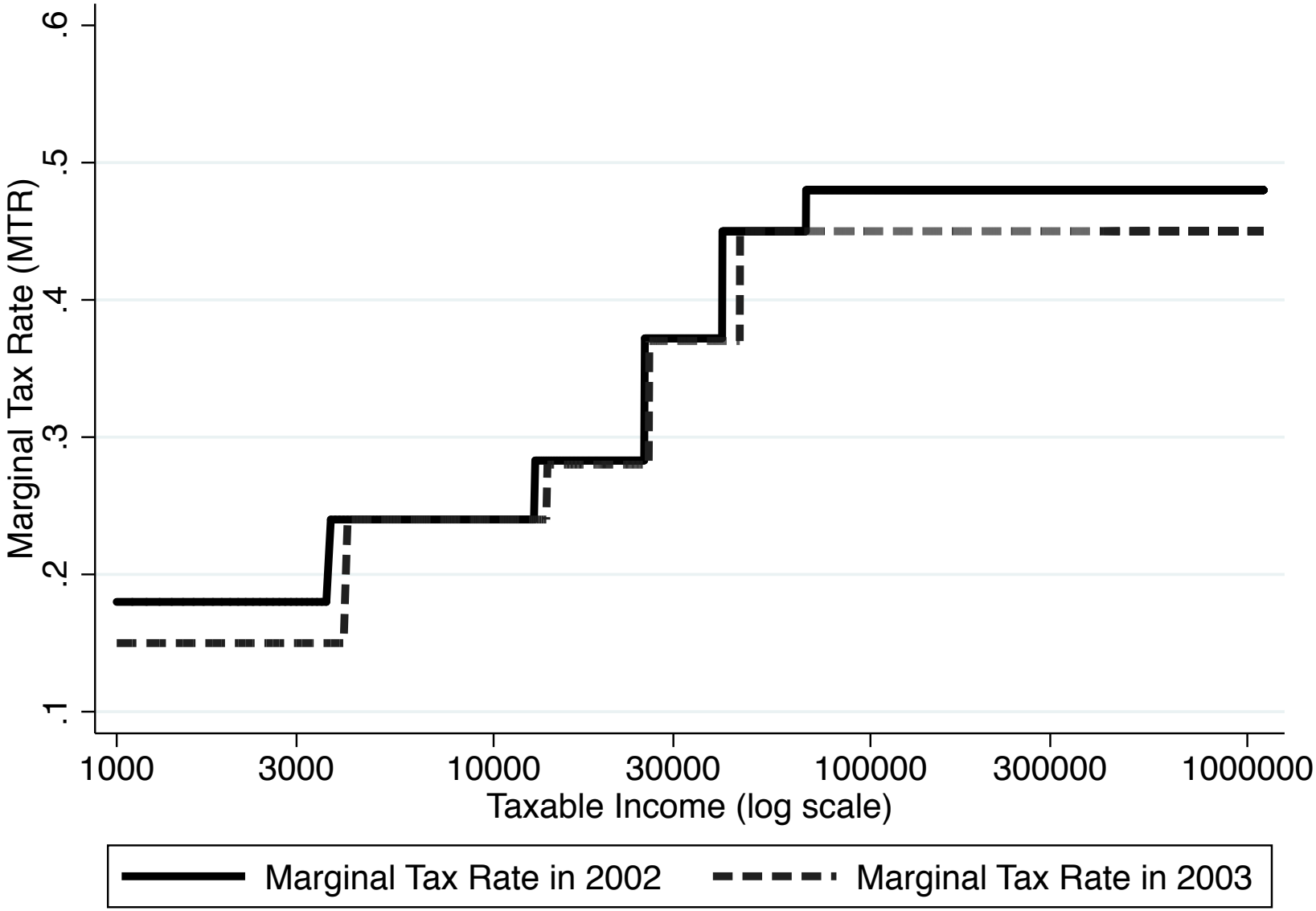
- The Spanish personal income tax (IRPF) defines **two separate tax bases**:
  - General base: labor, business and capital income (until 2006)
  - Savings (or "special" base): capital gains and financial capital income (since 2007)
- The general base is taxed with a **progressive tax schedule** (top MTR between 43% and 56%)
- The savings base is taxes with a **flat rate** around 20% (made somewhat progressive in 2011-2014)
- Since 2007, the personal & family deduction becomes a tax credit, increasing progressivity
- Since 2007, Autonomous Communities (CCAA) can determine their own tax rate schedules

Distribution of Income Sources

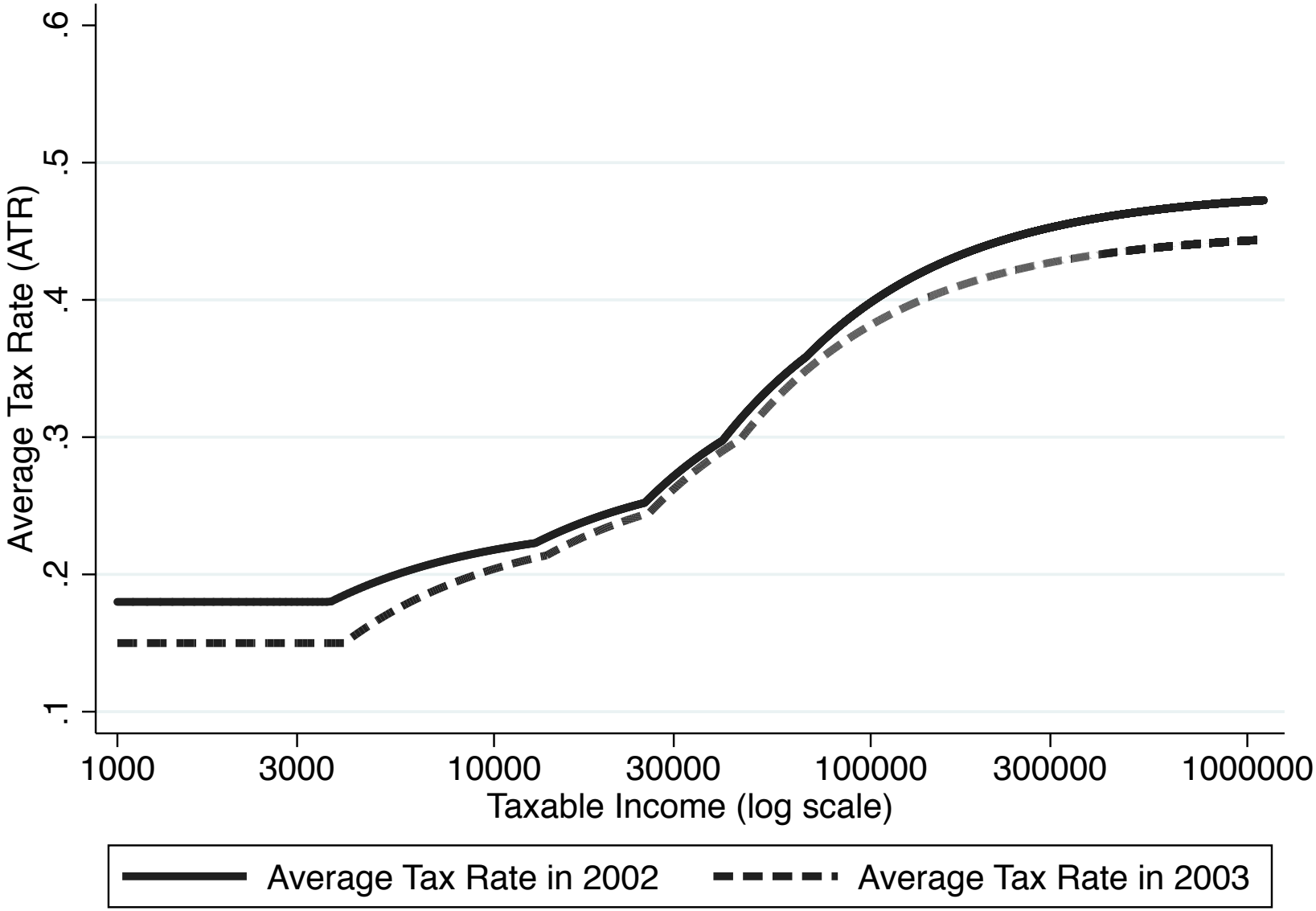
Income Source	Share of Income
Labor income	.790
Business income	.083
Direct estimation	.055
Objective est. & Agric.	.028
Capital income	.089
Capital gains	.039

Taxpayer Category	Share of Declarations
Employee	.820
Self-employed	.078
Direct estimation	.052
Objective est. & Agric.	.026
Saver	.048
Investor	.05

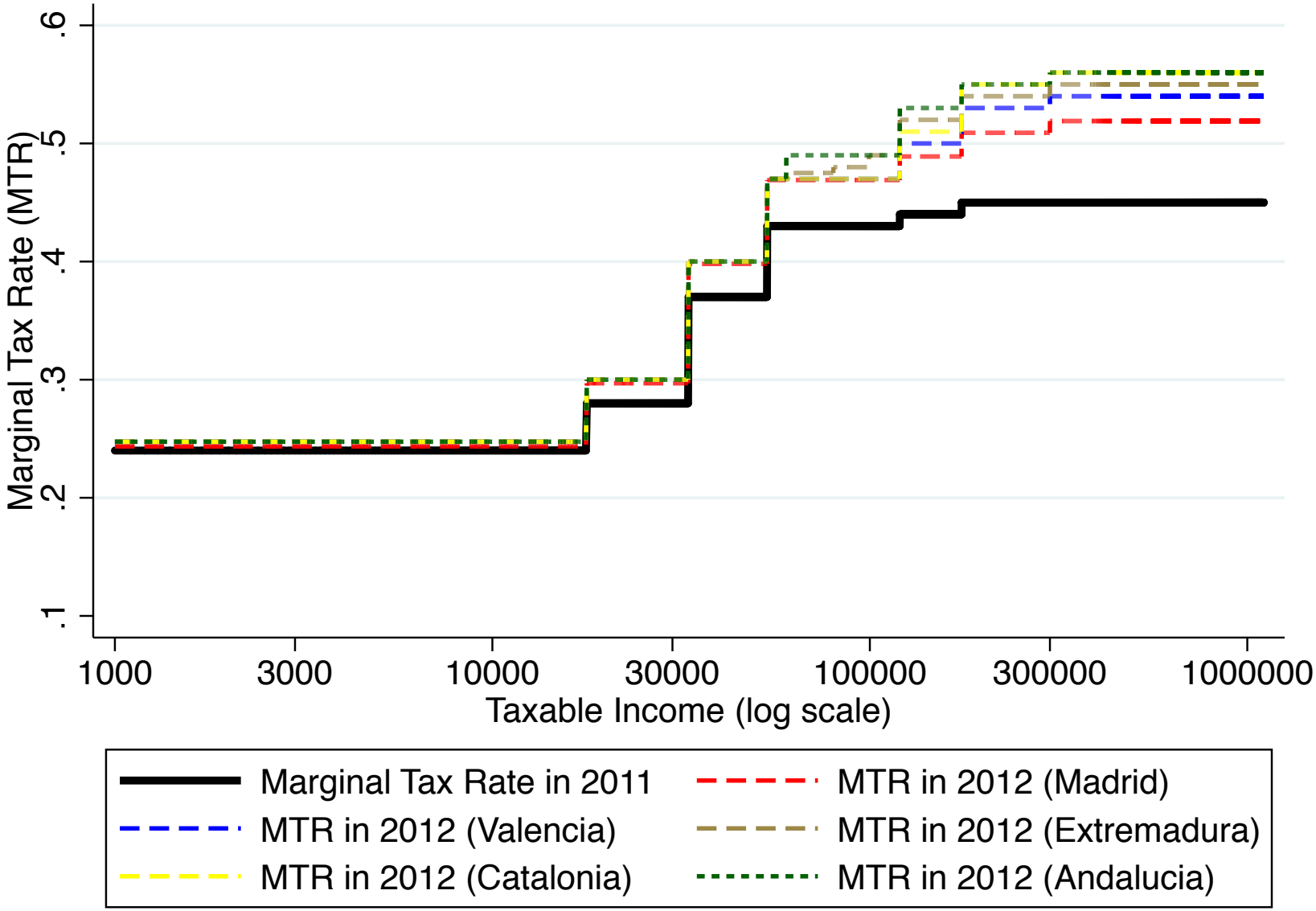
Marginal Tax Rates Before vs After 2003 Reform



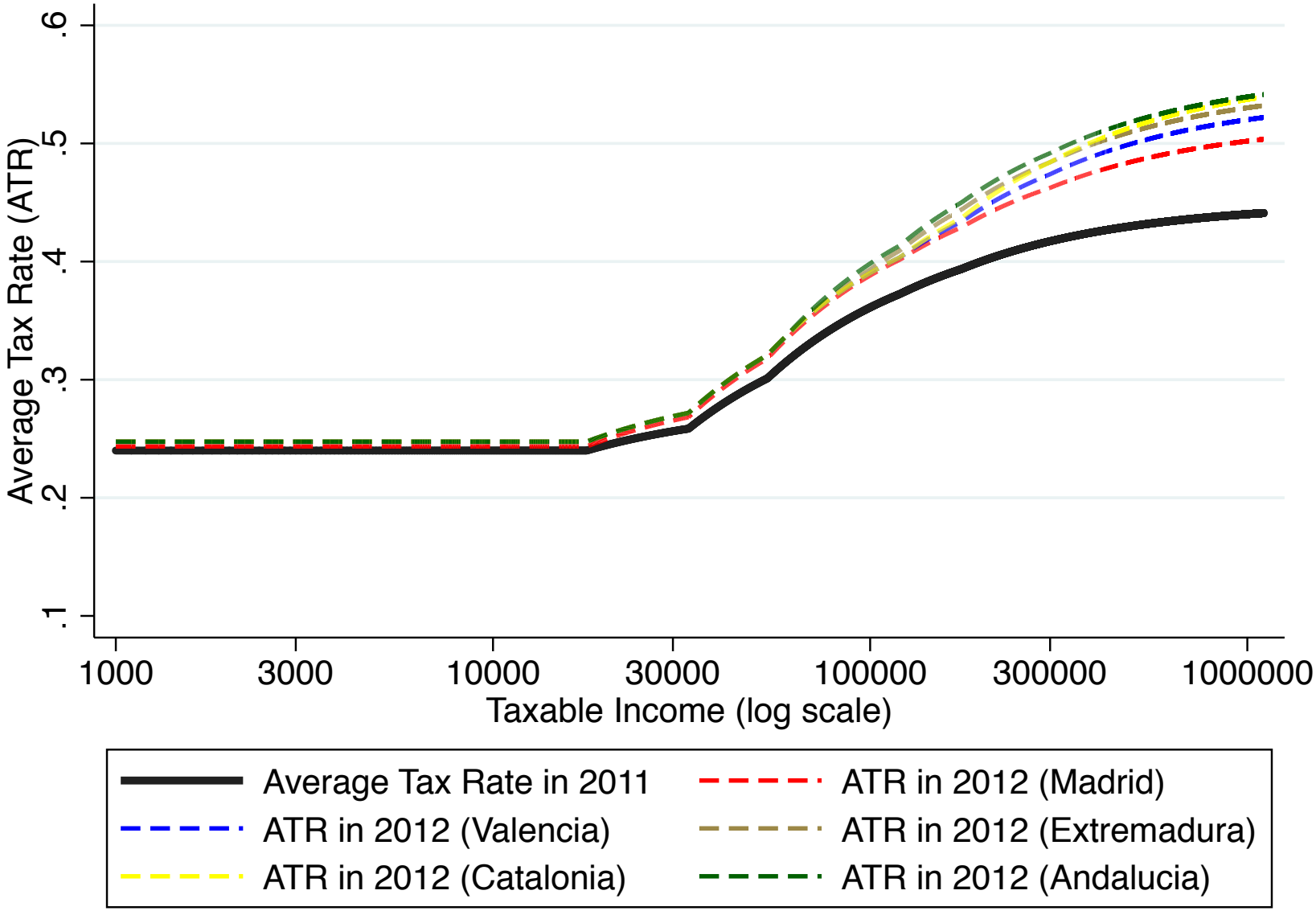
Average Tax Rates Before vs After 2003 Reform



Marginal Tax Rates Before vs After 2012 Reform



Average Tax Rates Before vs After 2012 Reform



Outline

Model Setup

- Consumption: $c = z - T(z)$, where z is taxable income and $T(z)$ is tax liability
- Utility: $u(c, z)$, where $u_c > 0, u_z < 0$
- Budget constraint: $c = (1 - \tau)z + v$, where $\tau \equiv T'(\cdot)$ is the marginal tax rate (MTR) and $v \equiv \tau z - T(z)$ is virtual income
- Optimal income choice: $z^* = z(1 - \tau, v)$
- **Log-log regression model**:

$$\ln(z_{it}) = \alpha + \varepsilon \ln(1 - \tau_{it}) + \eta \ln(v_{it}) + \gamma \mathbf{x}_{it} + \mu_i + v_{it}$$

Regression Framework

- Taking first differences (individual effect μ_i drops out):

$$\Delta \ln(z_{it}) = \varepsilon \Delta \ln(1 - \tau_{it}) + \eta \Delta \ln(v_{it}) + \Delta \gamma \mathbf{x}_{it} + u_{it}$$

- Endogeneity problem: $cov\left[\Delta \ln(z_{it}), \Delta \ln(1 - \tau_{it})\right] < 0$
  - Therefore: $\widehat{\varepsilon}^{OLS} < \varepsilon \Rightarrow$ OLS is biased downward
- Solution: **instrumental variables** (IV)
  - IV must isolate variation in MTR due to tax reforms (exogenous), from responses to taxation (endogenous)
  - IV strategy first proposed by Gruber and Saez (2002), updated by Weber (2014) and Kleven and Schultz (2014)

Constructing the Instruments

- Step 1: calculate marginal tax rates for each income source j

$$\tau_{it}^{j} = \frac{T_t(z_{it}^{j} + 10) - T_t(z_{it}^{j})}{10}, \text{where } j = \{L, Kf, Kr, B\}$$

- Step 2: compute MTR as a weighted average
- Step 3: calculate predicted MTR in year t assuming same income (in real terms) as in $t-3$

$$\tau_{it}^{p} = \frac{T_t(z_{it-3} + 10) - T_t(z_{it-3})}{10}$$

- Step 4: Definition of the instrument for $\Delta \ln(1 - \tau_{it})$

$$\Delta \ln(1 - \tau_{it}^{p}) = \ln\left(\frac{(1 - \tau_{it}^{p})}{(1 - \tau_{it-3})}\right)$$

Estimated Regressions

- First-stage regression:

$$\underbrace{\Delta \ln(1-\tau_{it})}_{\text{Change in NTR}} = \phi \underbrace{\Delta \ln(1-\tau_{it}^{p})}_{\text{IV}} + \Delta\gamma \mathbf{x}_{it} + w_{1it}$$

- **Second-stage regression**:

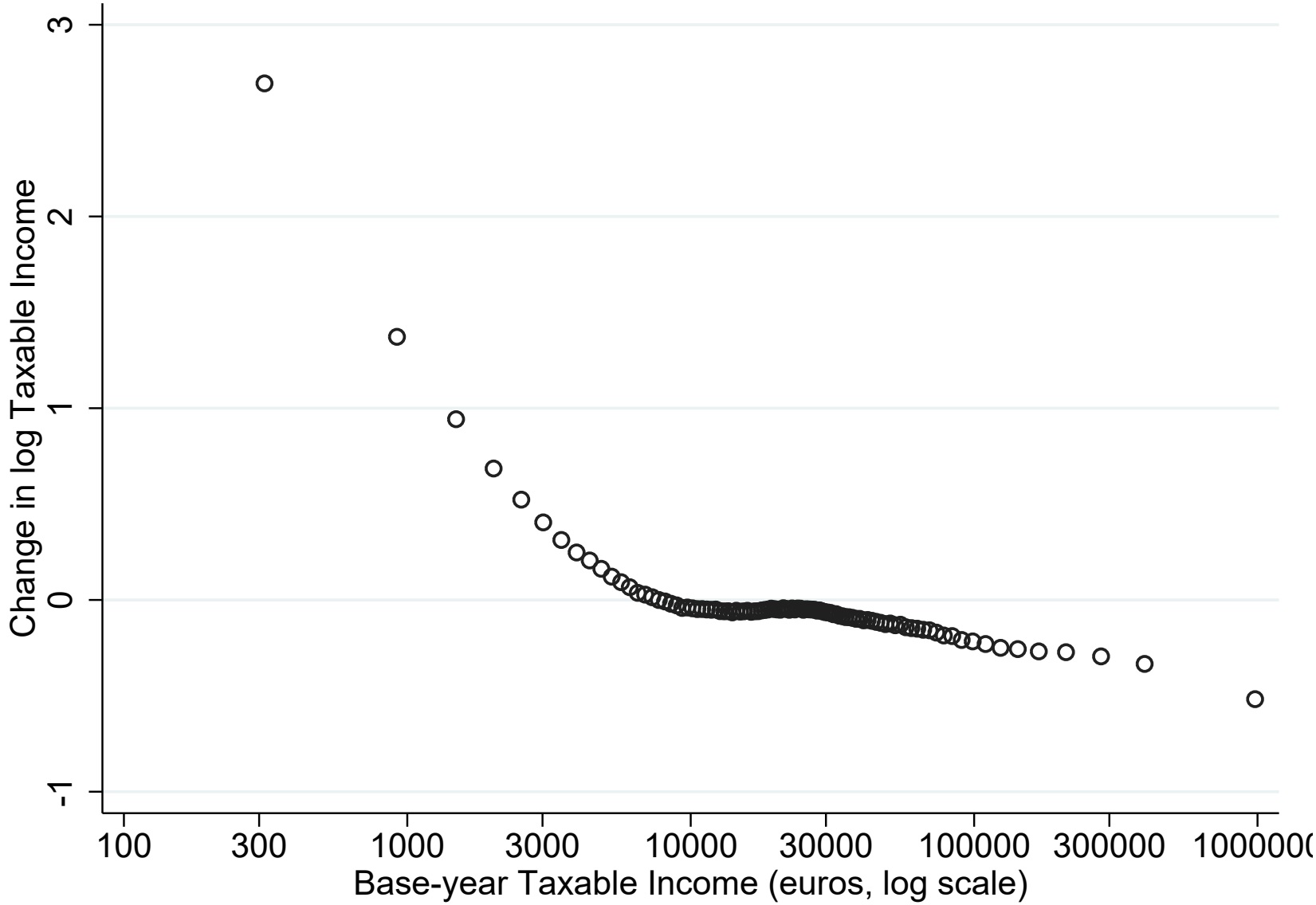
$$\underbrace{\Delta \ln(z_{it})}_{\text{Change in TaxInc}} = \varepsilon \underbrace{\Delta \widehat{\ln(1-\tau_{it})}}_{\text{Pred. Ch. NTR}} + \delta \Delta \mathbf{x}_{it} + u_{it}$$

- Reduced-form regression:

$$\underbrace{\Delta \ln(z_{it})}_{\text{Change in TaxInc}} = \rho_1 \underbrace{\Delta \ln(1-\tau_{it}^{p})}_{\text{IV}} + \rho_2 \Delta \mathbf{x}_{it} + r_{it}$$

Regs with Income Effects

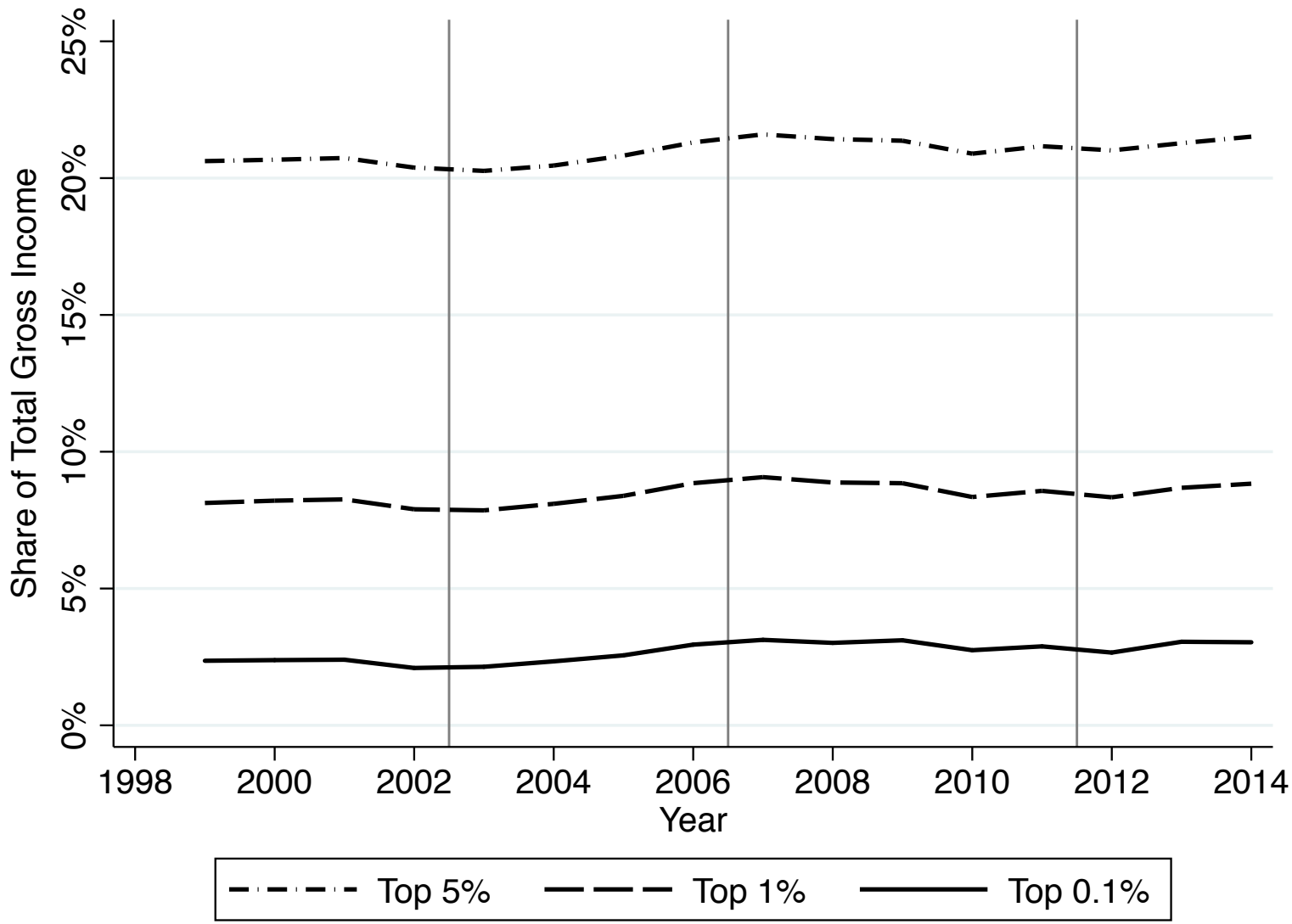
Issue #1: Mean Reversion (1999-2014)



Issue #2: Top Income Shares (1999-2014)

Excluding Capital Gains

▸ with K gains



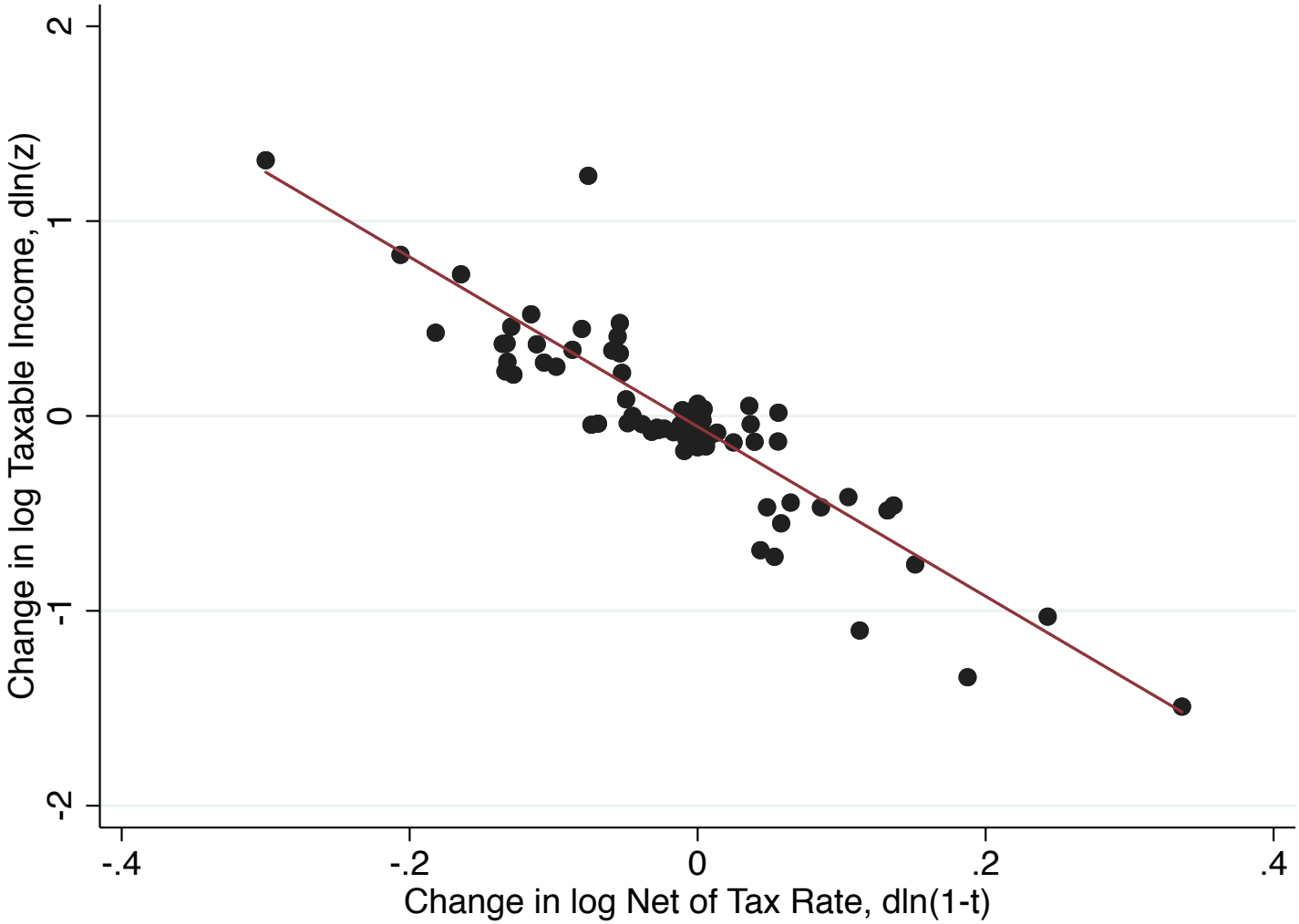
Addressing Empirical Challenges

- **Mean reversion issue is very strong**, especially at the *bottom* of the distribution
  - Control for nonlinear functions (splines) of base-year income
  - Robustness: exclude taxpayers with base-year income below €5,000 or €10,000
- **Heterogeneous income trends**:
  - Aggregate income distribution quite stable over time
  - There could be heterogeneous income trends for other reasons, eg. financial crisis
  - Use *lagged* splines of base-year income to address this
- Other **sample restrictions** (standard in the literature):
  - Exclude taxpayers with negative tax liability
  - Exclude pensioners (although similar results with pensioners)
  - Exclude capital gains from outcome variable (volatile, subject to re-timing behavior)

Outline

OLS Relationship

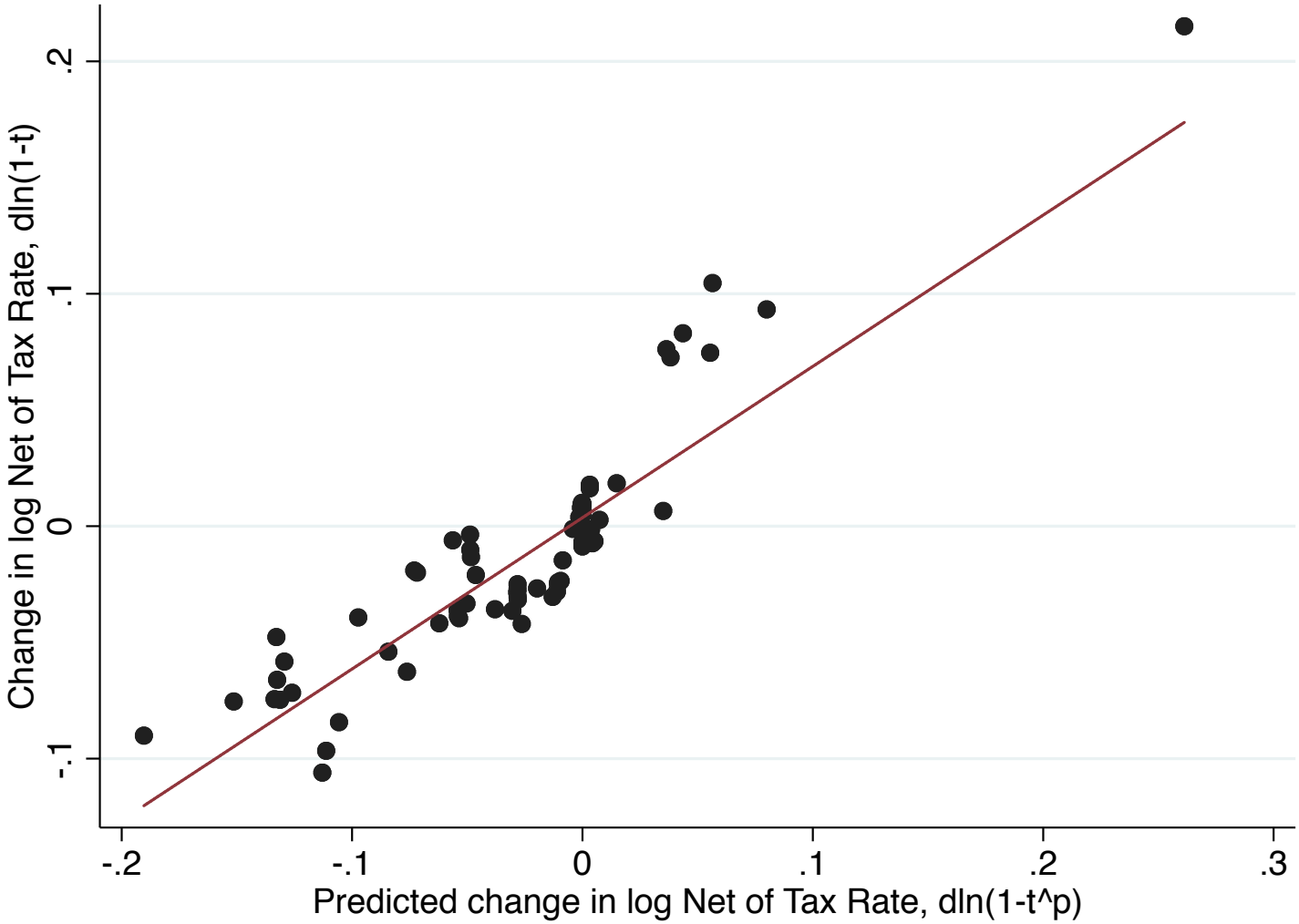
No controls, 1999-2014



$$\Delta \ln z_{it} = \beta_0 + \beta_1 \Delta(1 - \tau_{it}) + u_{it}$$

First-Stage Relationship

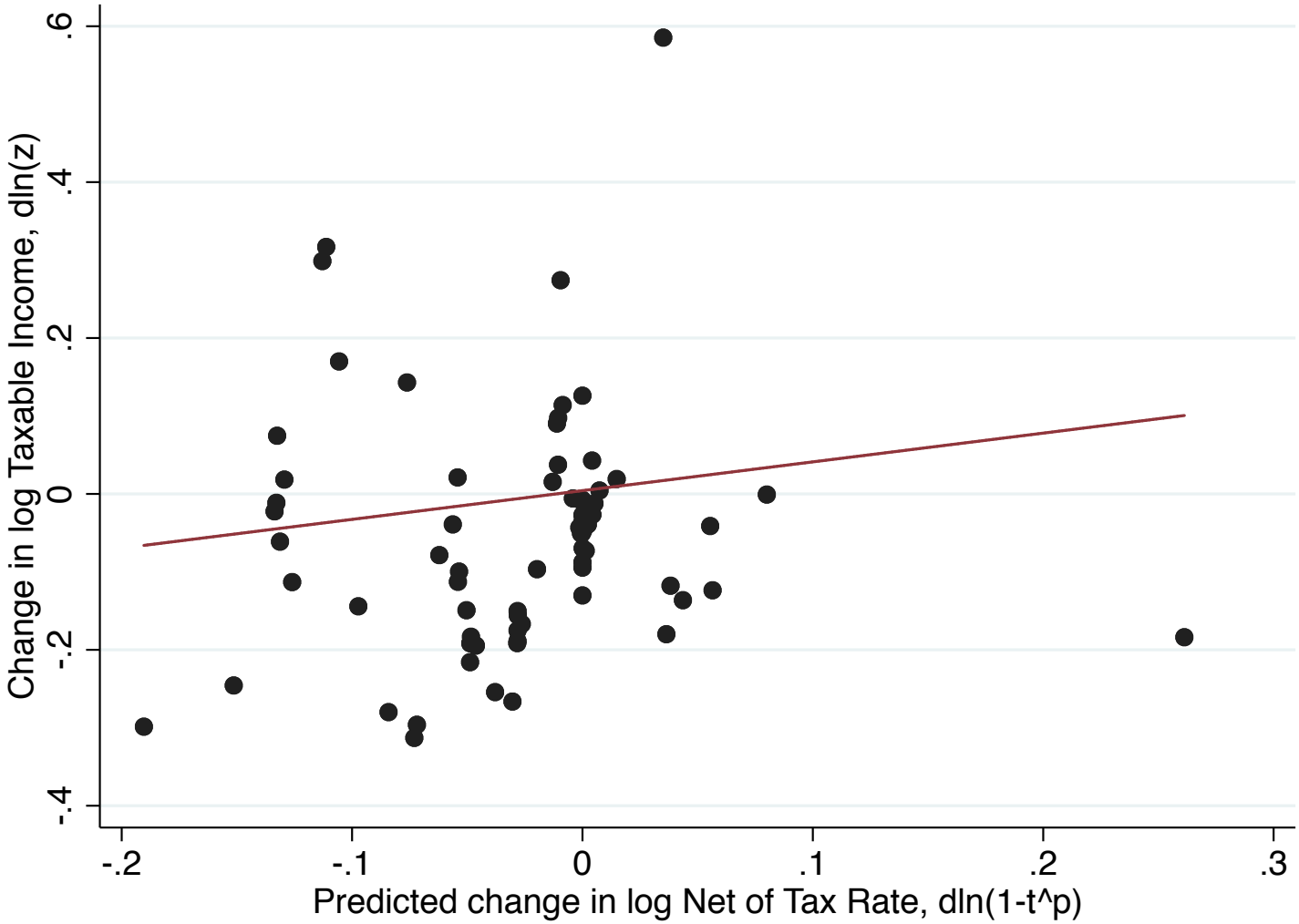
No controls, 1999-2014



$$\Delta(1-\tau_{it}) = \phi_0 + \phi_1 \Delta(1-\tau_{it}^p) + v_{it}$$

Reduced-Form Relationship

No controls, 1999-2014



$$\Delta \ln z_{it} = \rho_0 + \rho_1 \Delta(1 - \tau_{it}^p) + w_{it}$$

ETI for 1999-2014: Gruber-Saez Method

	OLS	1stStage	RedForm	Gruber-Saez		
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(1-\tau)$	-4.230***			0.322***	0.356***	0.343***
	(0.009)			(0.015)	(0.014)	(0.014)
$\Delta \ln(1-\tau^p)$		0.633***	0.204***			
		(0.001)	(0.009)			
Observations	4,012,332	4,012,332	4,014,214	4,012,332	4,012,332	4,012,332
Diff-in-Sargan p-value	-	-	-	0.00	0.00	0.00
Base-Year Splines	none	none	none	none	Cubic	Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
F-stat on IV		336,178				

ETI for 1999-2014: Alternative Methods

	Kleven-Schultz		Weber			
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(1-\tau)$	0.543***	0.538***	0.847***	0.816***	0.644***	0.628***
	(0.018)	(0.018)	(0.037)	(0.037)	(0.036)	(0.036)
$\Delta \ln(v)$	0.043***	0.043***				
	(0.001)	(0.001)				
Observations	3,538,825	3,538,5825	3,032,125	3,032,125	2,983,196	2,983,196
Diff-in-Sargan p-value	0.00	0.00	0.77	0.89	0.23	0.20
Base-Year Splines	Cubic	Log	Cubic	Log	Lag Cubic	Lag Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

ETI for Employees vs. Self-Employed

1999-2014 period

	Employees				Self-Employed			
	Gruber-Saez		K-Schultz	Weber	Gruber-Saez		K-Schultz	Weber
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta \ln(1-\tau)$	0.245***	0.232***	0.472***	0.349***	0.657***	0.692***	0.932***	1.452***
	(0.015)	(0.015)	(0.019)	(0.037)	(0.046)	(0.046)	(0.053)	(0.096)
$\Delta \ln(v)$			0.040***				0.052***	
			(0.001)				(0.003)	
Observations	3,435,507	3,435,507	3,068,501	2,573,719	411,207	411,207	339,946	289,264
Base-Year Splines	Cubic	Log	Cubic	Lag Cubic	Cubic	Log	Cubic	Lag Cubic
Weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Elasticity of Broad Income (EBI)

1999-2014 period

	Gruber-Saez		Kleven-Schultz		Weber	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln(1-\tau)$	0.131***	0.132***	0.104***	0.105***	0.238***	0.233***
	(0.011)	(0.011)	(0.013)	(0.013)	(0.025)	(0.025)
$\Delta \ln(v)$			0.008***	0.008***		
			(0.000)	(0.000)		
Observations	3,439,943	3,439,943	3,133,419	3,133,419	2,983,015	2,983,015
Base-Year Splines	Lag Cubic	Lag Log	Lag Cubic	Lag Log	Lag Cubic	Lag Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

Elasticity of Tax Deductions

1999-2014 period

	Gruber-Saez			Kleven-Schultz		Weber	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: Total Deductions						
$\Delta \ln(1-\tau)$	-0.214***	-0.144***	-0.152***	-0.327***	-0.337***	-0.395***	-0.405***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.016)	(0.017)
	Panel B: Total Deductions except Personal & Family Deduction						
$\Delta \ln(1-\tau)$	-0.338***	-0.229***	-0.236***	-0.493***	-0.504***	-0.674***	-0.697***
	(0.013)	(0.013)	(0.014)	(0.015)	(0.016)	(0.031)	(0.032)
	Panel C: Deduction for Private Pension Contributions						
$\Delta \ln(1-\tau)$	-0.626***	-0.651***	-0.672***	-0.943***	-0.954***	-1.365***	-1.413***
	(0.026)	(0.026)	(0.027)	(0.036)	(0.036)	(0.057)	(0.058)
Base-Year Splines	none	Cubic	Log	Cubic	Log	Lag Cubic	Lag Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Discussion of Results

- The overall ETI in Spain for this period was around **0.4-0.8**
  - Using long panel data (1999-2014) from IEF and state-of-the-art empirical techniques
- Self-employed taxpayers have a much higher ETI (0.6-1.4) than wage employees (0.2-0.45)
  - As predicted by economic theory: larger scope to react
- The elasticity of broad income (EBI) is modest (0.1-0.25), while the elasticity of deductions is high (0.2-0.6), especially contributions to pension plans (0.7-1.4)
  - Most of the response to the personal income tax through deductions, but significant real and evasion responses

Robustness: Dropping Low Base-year Incomes

1999-2014 period

	Gruber-Saez		Kleven-Schultz		Weber	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Base-year Broad Income $y_{i,t-3} >$ €5,000					
$\Delta \ln(1-\tau)$	0.362***	0.350***	0.551***	0.545***	0.644***	0.628***
	(0.014)	(0.014)	(0.018)	(0.018)	(0.036)	(0.036)
Observations	4,009,988	4,009,988	3,537,959	3,537,959	2,982,049	2,982,049
	Panel B: Base-year Broad Income $y_{i,t-3} >$ €10,000					
$\Delta \ln(1-\tau)$	0.383***	0.376***	0.575***	0.571***	0.599***	0.588***
	(0.014)	(0.014)	(0.018)	(0.018)	(0.036)	(0.035)
Observations	3,947,751	3,947,751	3,497,541	3,497,541	2,946,560	2,946,560
Base-Year Splines	Cubic	Log	Cubic	Log	Lag Cubic	Lag Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

Robustness: 2-year and 1-year differences

1999-2014 period

	Gruber-Saez		Kleven-Schultz		Weber	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Two-year Differences					
$\Delta \ln(1-\tau)$	0.597***	0.626***	0.656***	0.670***	0.685***	0.670***
	(0.014)	(0.014)	(0.019)	(0.018)	(0.052)	(0.052
Observations	4,346,095	4,346,095	3,660,232	3,660,232	3,207,981	3,207,981
	Panel B: One-year Differences					
$\Delta \ln(1-\tau)$	0.746***	0.802***	0.651***	0.687***	0.535***	0.514***
	(0.015)	(0.015)	(0.019)	(0.019)	(0.098)	(0.097)
Observations	5,101,898	5,101,898	4,126,532	4,126,532	3,519,483	3,519,483
Base-Year Splines	Cubic	Log	Cubic	Log	Lag Cubic	Lag Log
Weights	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes

Outline

Concluding Remarks

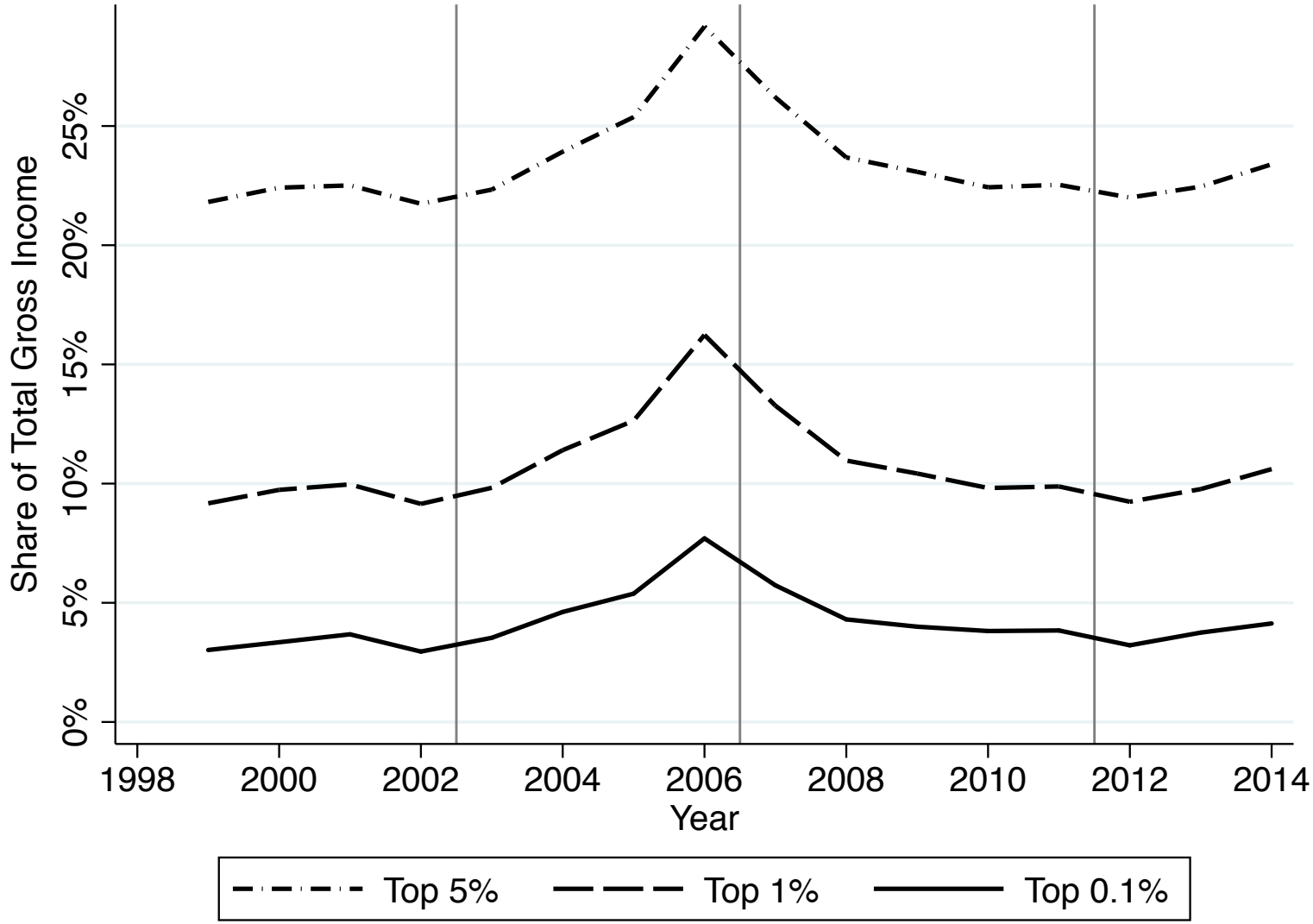
- We estimate that the ETI in Spain was $\in (0.4, 0.8)$ for the 1999-2014 period
- These estimates are comparable to "consensus" estimates for the US, also in line with other EU countries (see Doerrenberg et al. 2017 for Germany)
  - Within the **wide range** of existing estimates for Spain:
  - $\varepsilon = 0.12$ (Sanmartin, 2007), $\varepsilon = 0.41$ (Diaz-Caro & Onrubia, 2015), and $\varepsilon = 1.5$ (Sanz-Sanz et al, 2016)
- ETI is below the revenue-maximizing (Laffer) rate
  - If $\widehat{\varepsilon} > \left(\frac{1-\tau}{\tau}\right)$, then $\uparrow \tau$ does not further increase tax revenue
  - Laffer rate is $\approx 71\%$ with ETI$= 0.4$, $\approx 66\%$ with ETI$= 0.6$ and $\approx 55\%$ with ETI$= 0.8$

THANK YOU!

Evolution of Top Income Shares (1999-2014)

Including Capital Gains

back



Estimated Regressions, with Income Effects

- First-stage regressions:

$$\underbrace{\Delta \ln(1-\tau_{it})}_{\text{Change in NTR}} = \phi_1 \underbrace{\Delta \ln(1-\tau_{it}^{p})}_{\text{IV1}} + \Delta\gamma_1 \mathbf{x}_{it} + w_{1it}$$

$$\underbrace{\Delta \ln(1-v_{it})}_{\text{Change in V. Inc.}} = \phi_2 \underbrace{\Delta \ln(1-v_{it}^{p})}_{\text{IV2}} + \Delta\gamma_2 \mathbf{x}_{it} + w_{2it}$$

- **Second-stage regression**:

$$\underbrace{\Delta \ln(z_{it})}_{\text{Change in TaxInc}} = \varepsilon \Delta \widehat{\ln(1-\tau_{it})} + \eta \Delta \widehat{\ln(v_{it})} + \Delta\delta x_{it} + u_{it}$$

- Reduced-form regression:

$$\Delta \ln(z_{it}) = \rho_1 \Delta \ln(1-\tau_{it}^{p}) + \rho_2 \Delta \ln(v_{it}^{p}) + \rho_3 \Delta \mathbf{x}_{it} + r_{it}$$