Local Pass-Through and the Regressivity of Taxes

Evidence from Automotive Fuel Markets

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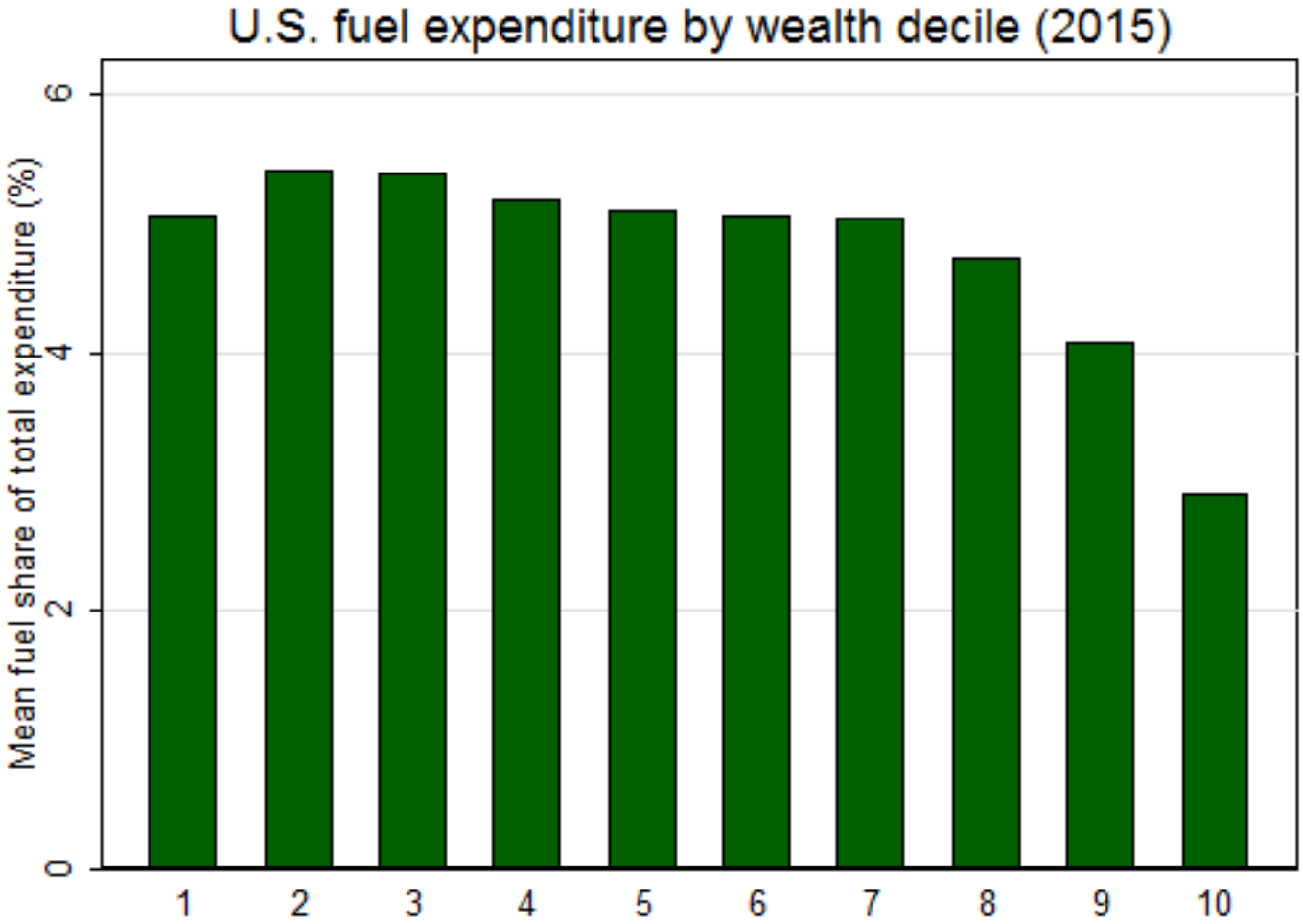
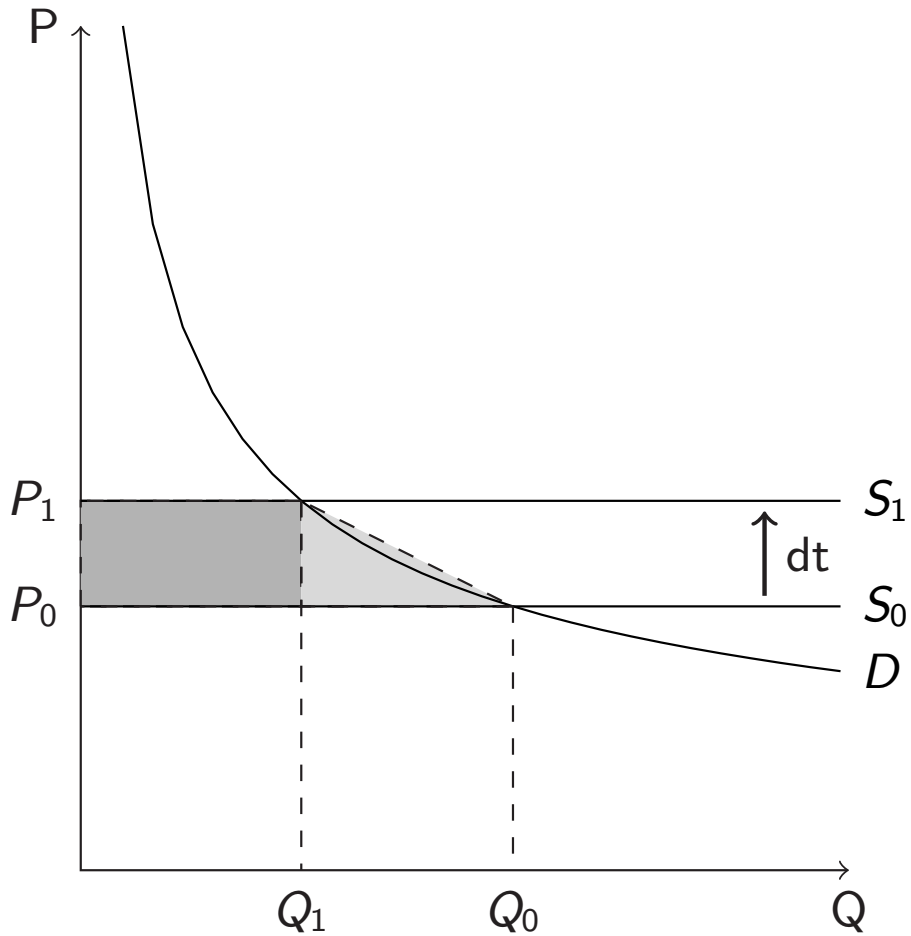
Usual story: relative quantities dictates regressivity



Source: CES (2015)

Point of this paper: relative prices matter too!



▸ Monopoly graphs ▸ Equations

This paper

What I do:

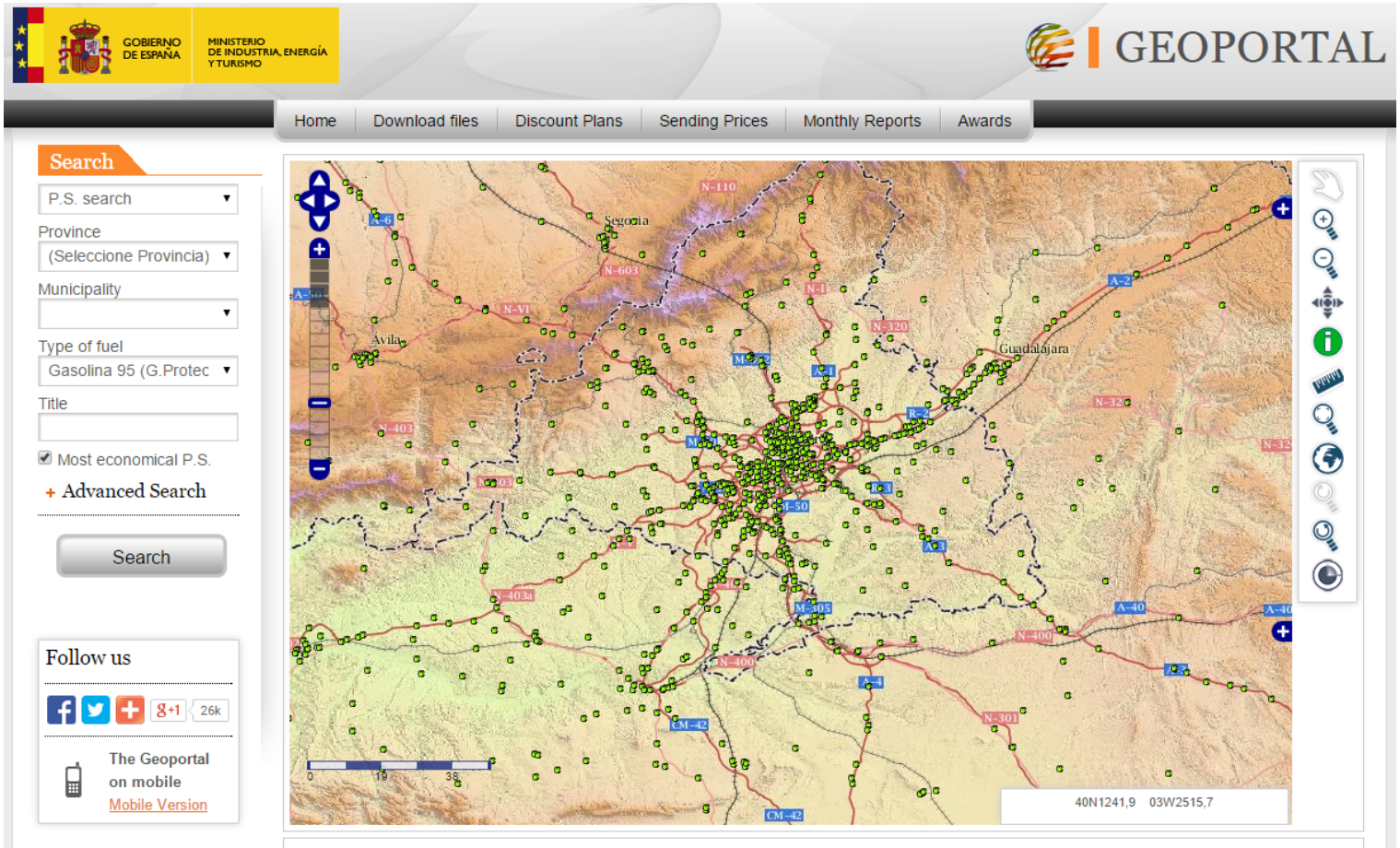
- Empirically measure tax pass-through and its effect on distributional equity in one particular context:
  - The Spanish market for automotive fuel
- Quantify not just *average* pass-through but also *local* pass-through, as a function of market conditions:
  - Degree of competition
  - Wealth of local consumers
- Link price impacts to welfare impacts, by wealth bracket

Bridging different strands of econ literature

Existing work on pass-through and distributional welfare

- Empirical pass-through literature
  - PT varies widely by type of good
    - E.g., Besley and Rosen (1999)
  - PT can vary with local market conditions
    - E.g., Marion and Muehlegger (2011)
- Pass-through under imperfect competition
  - Underlying primitives determine PT patterns
    - E.g., Weyl and Fabinger (2013)
  - PT can be used to ID other important parameters
    - E.g., Atkin and Donaldson (2016)
- Distributional welfare impacts of taxation
  - Caspersen and Metcalf (1994); Gruber and Koszegi (2004); West and Williams (2004); Bento et al. (2009)

Geoportal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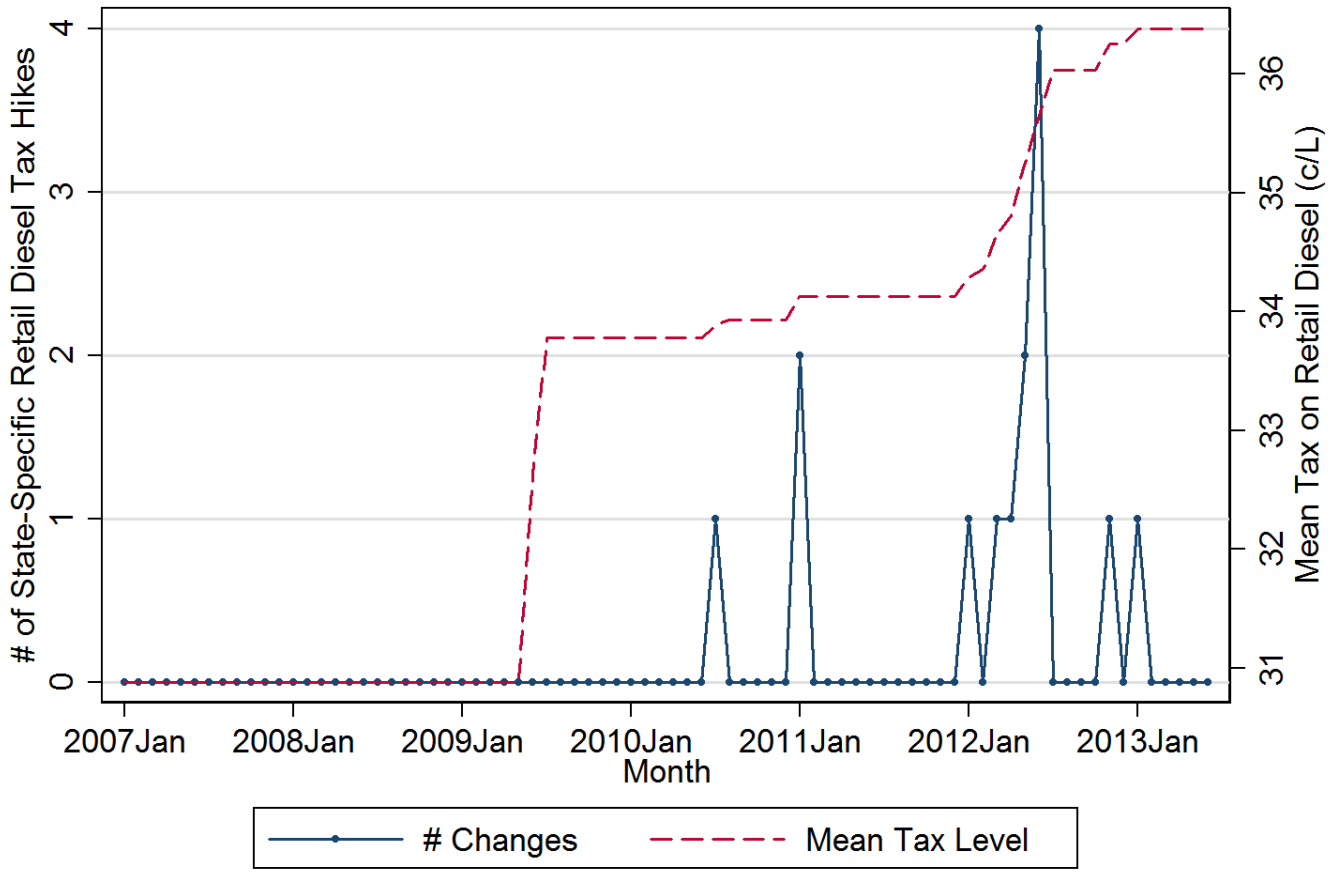
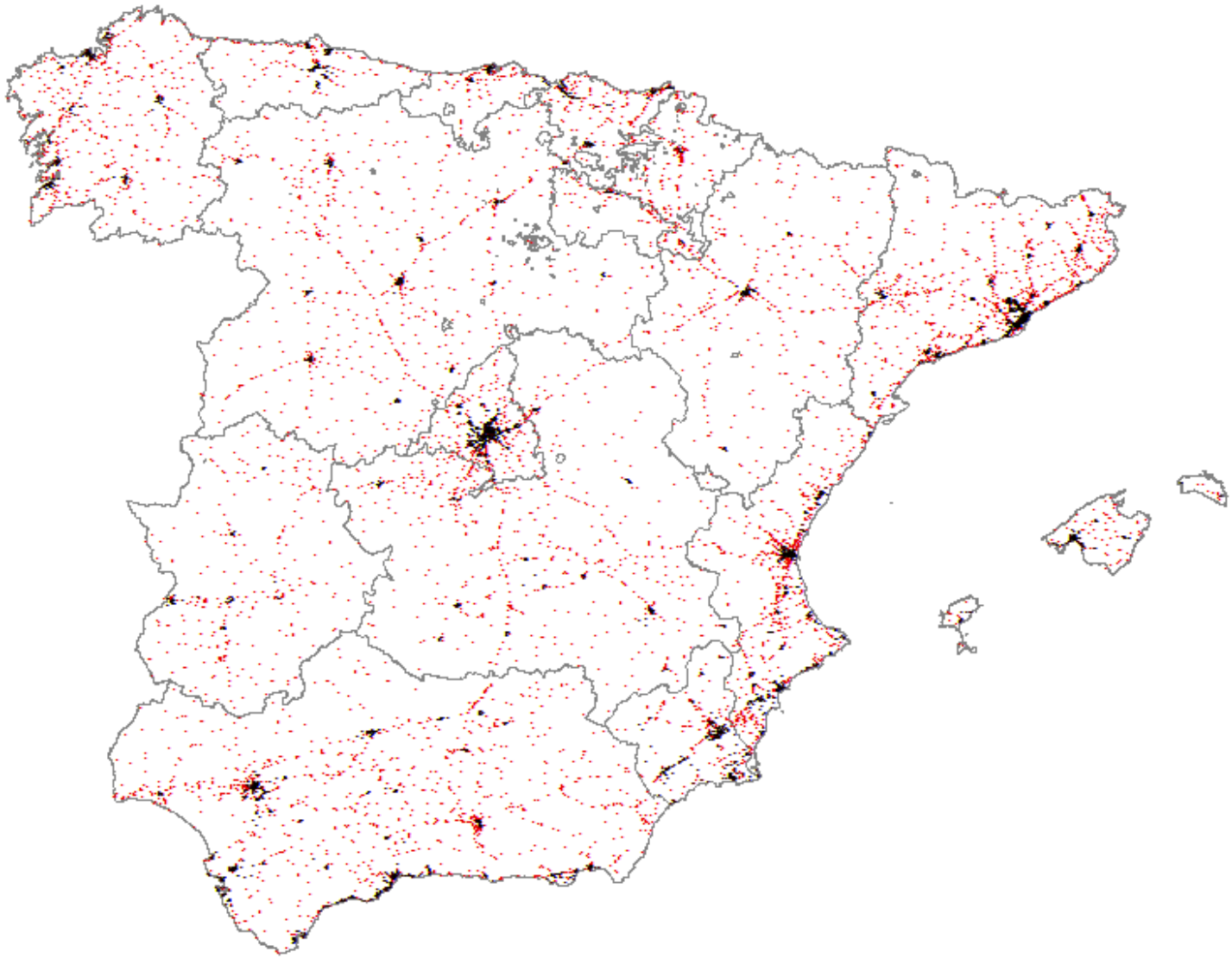
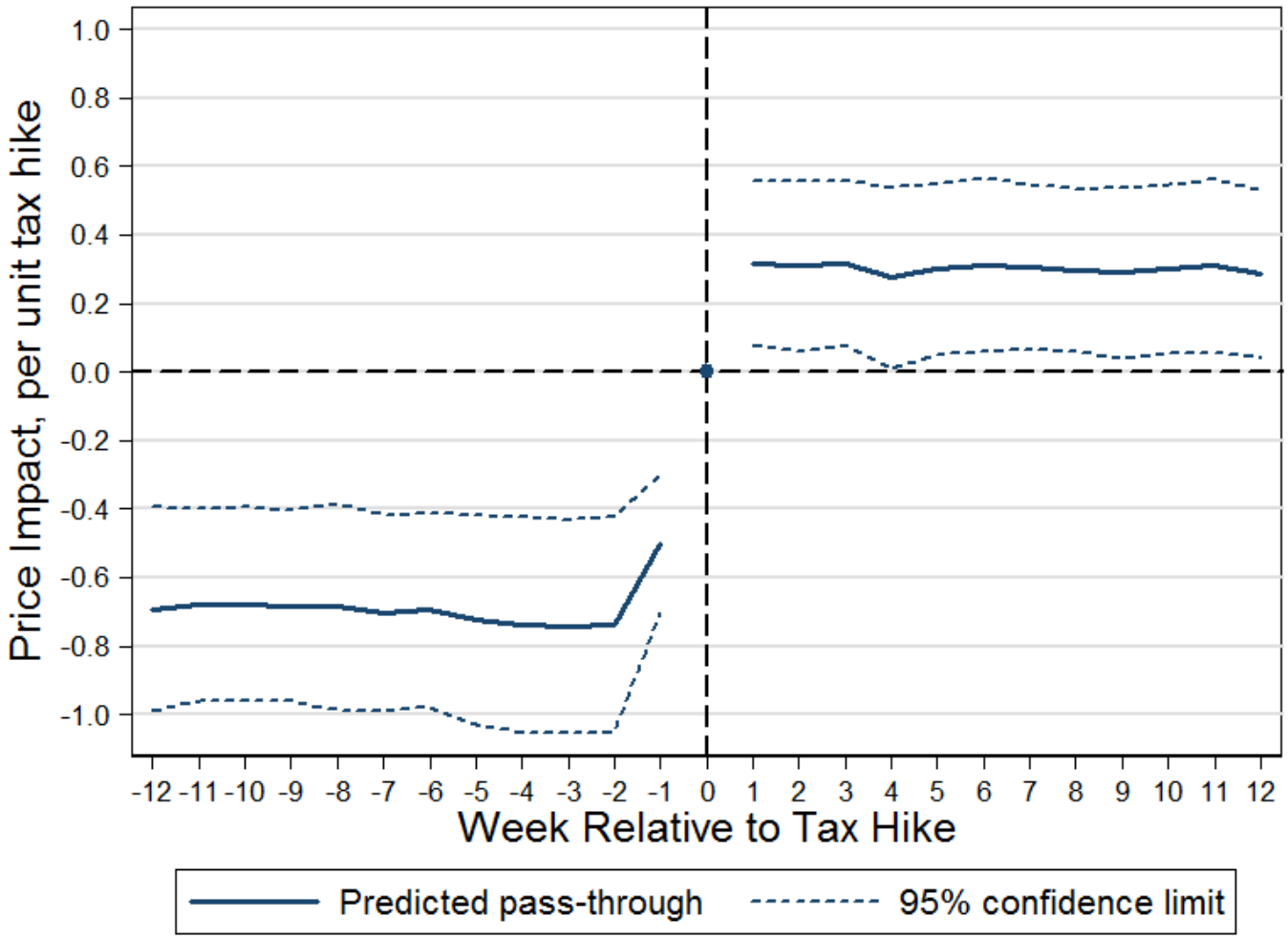


Analysis sample



▸ Station summary stats ▸ Price variation ▸ Geographic summary stats

Price impacts of tax hikes are mean shifts



▸ ES estimating equation

Average pass-through is essentially 100%

	Dependent variable: retail diesel price (c/l)				
	(1)	(2)	(3)	(4)	(5)
Mean tax level (c/l)	0.940***	0.944***	0.940***	0.931***	0.934***
	(0.035)	(0.037)	(0.026)	(0.036)	(0.032)
Count of stations w/in 5 min.				-0.275	-0.178*
				(0.161)	(0.092)
Own-firm proportion				0.287**	0.192
				(0.133)	(0.112)
Geographic sample	National	Urban	Urban	Urban	Urban
First differences			X		
Controls				X	X
State-year FE					X
R-Squared	0.995	0.996	0.822	0.996	0.996
N	2,622,605	1,018,072	1,005,016	1,018,072	1,018,072

▸ FE estimating equations

Pass-through rises in market power

	Dependent variable: retail diesel price (c/l)				
	(1)	(2)	(3)	(4)	(5)
Mean tax level (c/l)	0.837***	0.936***	0.891***	0.821***	0.811***
	(0.028)	(0.032)	(0.029)	(0.028)	(0.029)
Mean tax level	0.137***			0.131***	0.128***
X 1[Refiner]	(0.022)			(0.021)	(0.019)
Mean tax level		-0.048		-0.056	0.000
X # of rivals w/in 5 min		(0.041)		(0.039)	(0.020)
Mean tax level			0.092***	0.049**	0.031
X Own-firm proportion			(0.023)	(0.021)	(0.026)
Sample	Urban	Urban	Urban	Urban	Rural
R-Squared	0.996	0.996	0.996	0.996	0.995
N	1,018,072	1,018,072	1,018,072	1,018,072	1,604,090

▸ Event study by degree of competition

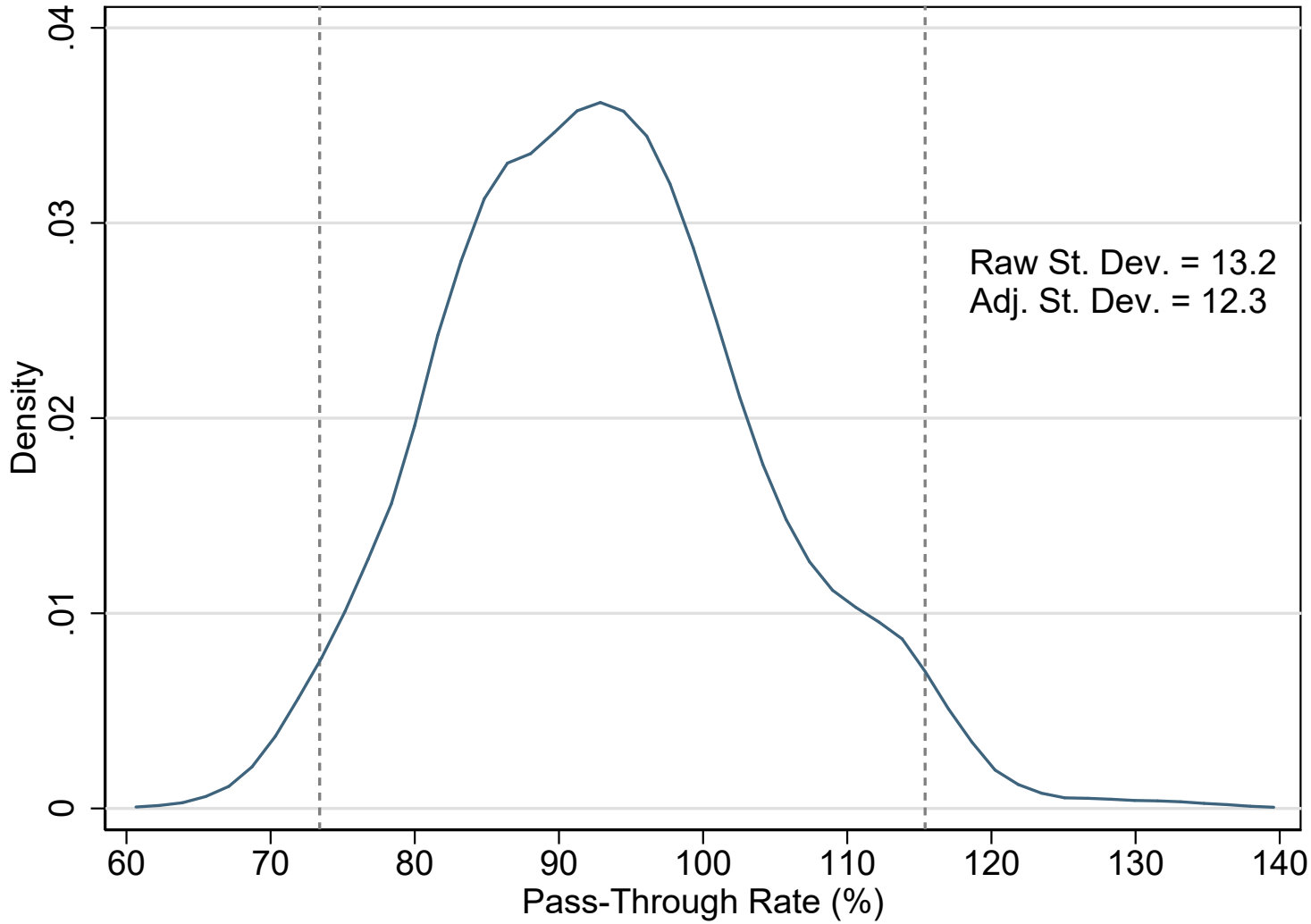
Pass-through rises in wealth

	Dep. var.: retail diesel price (c/l)		
	(1)	(2)	(3)
Mean tax level (c/l)	0.758***	0.916***	0.920***
	(0.074)	(0.030)	(0.030)
Mean tax level X Avg. house price	0.122**		
	(0.047)		
Mean tax level X 1[Avg. house price in 2nd quartile]		0.072***	0.061**
		(0.020)	(0.027)
Mean tax level X 1[Avg. house price in 3rd quartile]		0.110***	0.100**
		(0.037)	(0.039)
Mean tax level X 1[Avg. house price in 4th quartile]		0.172***	0.178***
		(0.054)	(0.053)
Mean tax level X 1[Avg. house price missing]			0.012
			(0.024)
Sample	Urban	Urban	National
R-Squared	0.999	0.999	0.996
N	6,766	6,766	77,465

Putting it all together

	Dep. var.: retail diesel price (c/l)	
	(1)	(2)
Mean tax level (c/l)	0.596***	0.532***
	(0.080)	(0.114)
Mean tax level	0.114***	0.103***
X 1[Refiner]	(0.018)	(0.022)
Mean tax level	-0.063	-0.053**
X 1[# of rivals w/in 5 min.]	(0.039)	(0.024)
Mean tax level	0.057**	0.083***
X 1[Own-firm proportion]	(0.023)	(0.024)
Mean tax level	0.152***	0.123***
X 1[Avg. house price]	(0.047)	(0.043)
Controls		X
R-Squared	0.996	0.996
N	1,018,072	732,486

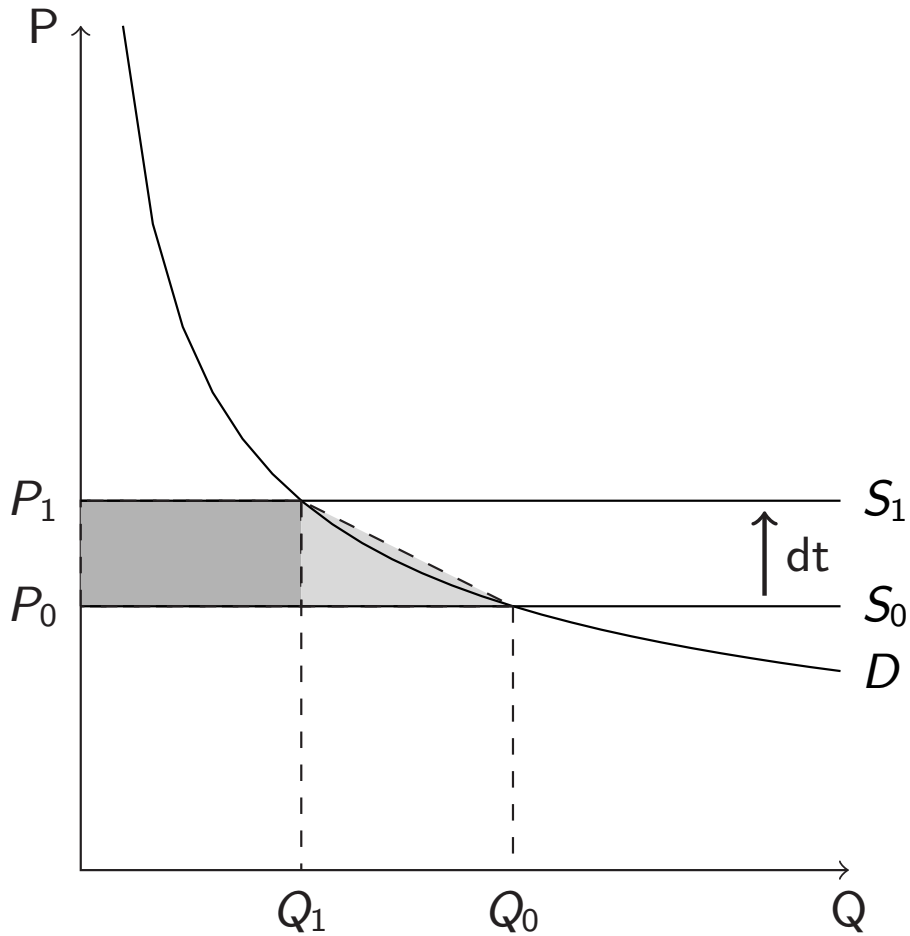
Empirical distribution of pass-through rates



What about the long-run?

	8-week effect on retail diesel price (c/l)		
	(1)	(2)	(3)
Crude oil price (c/l)	1.038***	0.967***	0.965***
	(0.003)	(0.011)	(0.011)
Crude oil price		0.041***	0.042***
X 1[Avg. house price]		(0.005)	(0.005)
Crude oil price			-0.007**
X 1[Refiner]			(0.003)
Crude oil price			0.010*
X 1[Own-firm proportion]			(0.006)
Crude oil price			-0.004
X 1[# of rivals w/in 5 min]			(0.009)
R-Squared	0.569	0.573	0.578
N	961,385	961,385	961,385

Pass-through vs. welfare

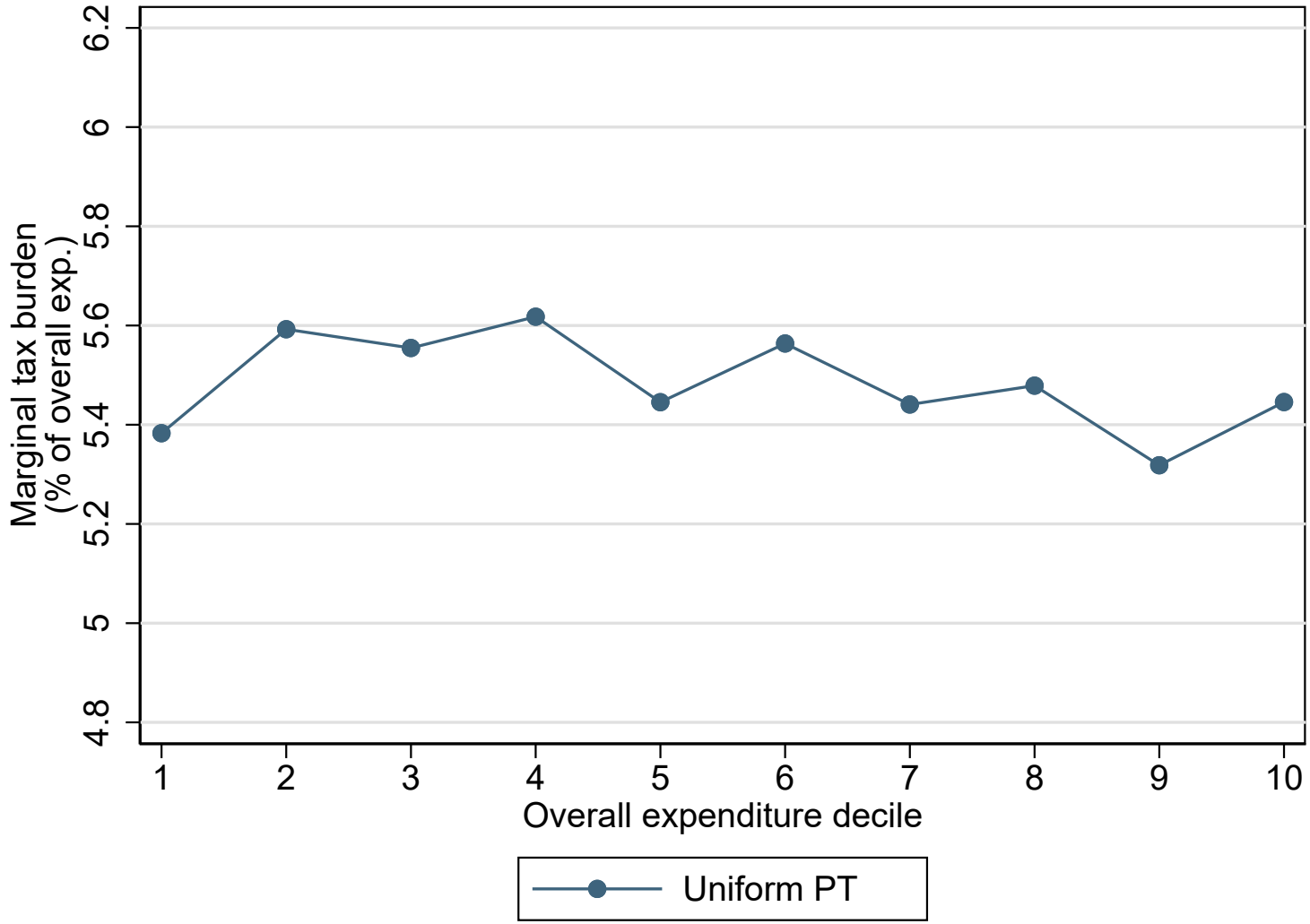


Incidence calculation

Goal: estimate proportional tax burdens by wealth bracket

- Following Poterba (1991), Fullerton and West (2003), and Treasury OTA
- Collect data on household consumption of automotive fuel (Q^{fuel}) and total expenditure (E^{tot})
- Graph average ($\frac{Q^{fuel}}{E^{tot}}$) by decile of E^{tot}
  - Accurately depicts relative tax burdens only if $\frac{dp}{dt}$ is uniform
- Compare to using ($\frac{Q^{fuel}}{E^{tot}}$) $* \frac{dp}{dt}$, where $\frac{dp}{dt}$ is the corresponding wealth-decile specific pass-through rate
  - Assumes house-price decile equals expenditure decile

Is the Spanish diesel tax regressive?



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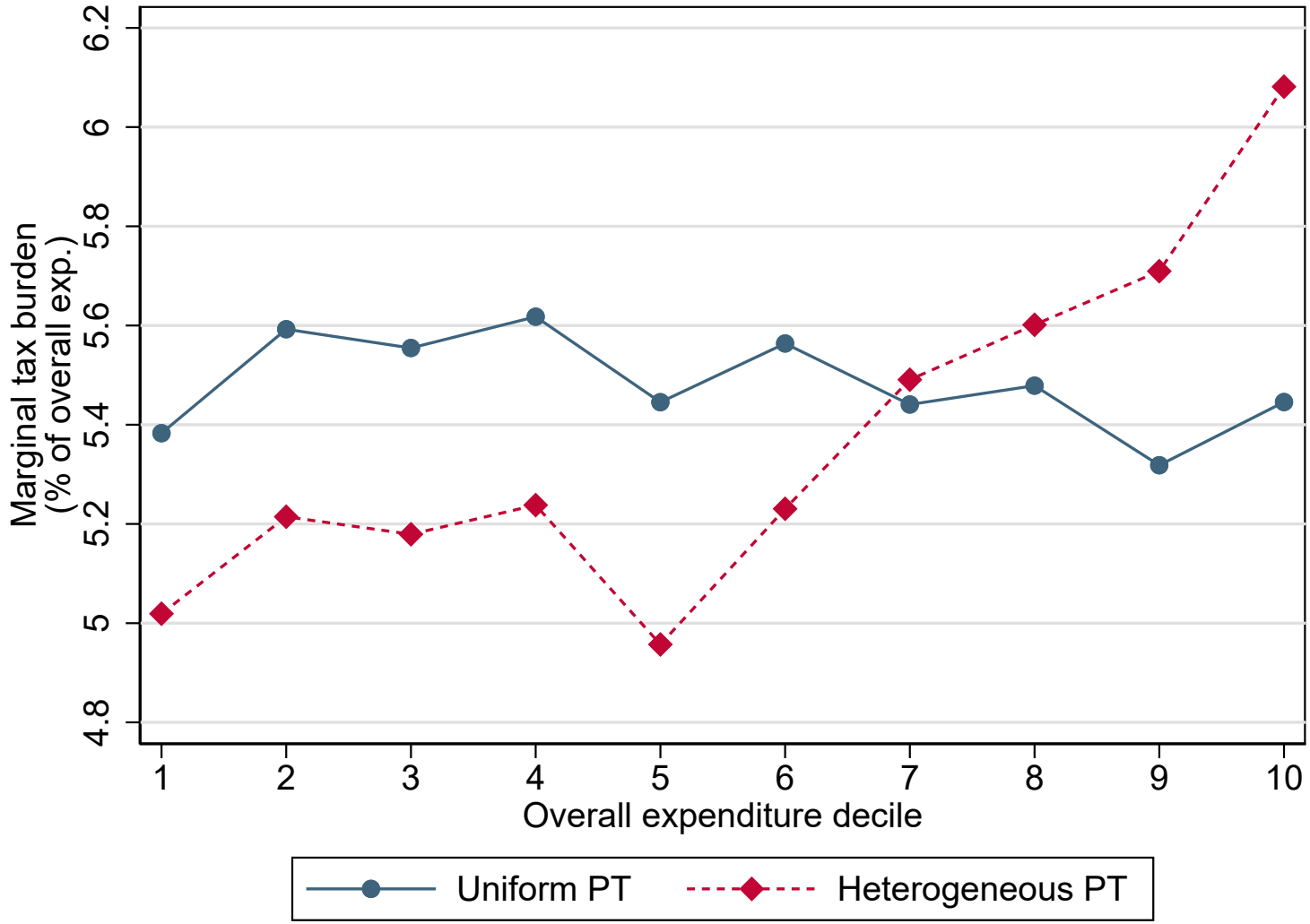


Summary of findings so far

Pass-through is highly variable at the local level

- Rises in market power
- Rises in house prices
- Runs from approximately 70% to 120%
- Magnitude all but disappears for input cost PT

Has significant implications for modeling and welfare analysis

- Demand is convex
- The tax appears progressive

Broader points

Pass-through is a first-order input to calculations of regressivity

- Pass-through – wealth relationship dictates the sign/magnitude of bias in existing regressivity calculations

Underlying logic is variation in market structure and demand elasticities

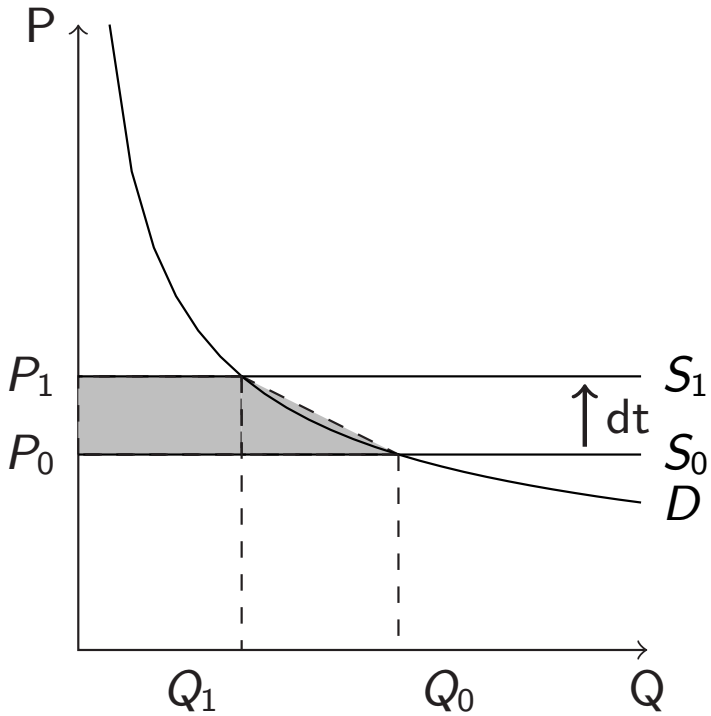
- Perfect competition doesn't cut it

Response to tax changes differs from response to input cost changes

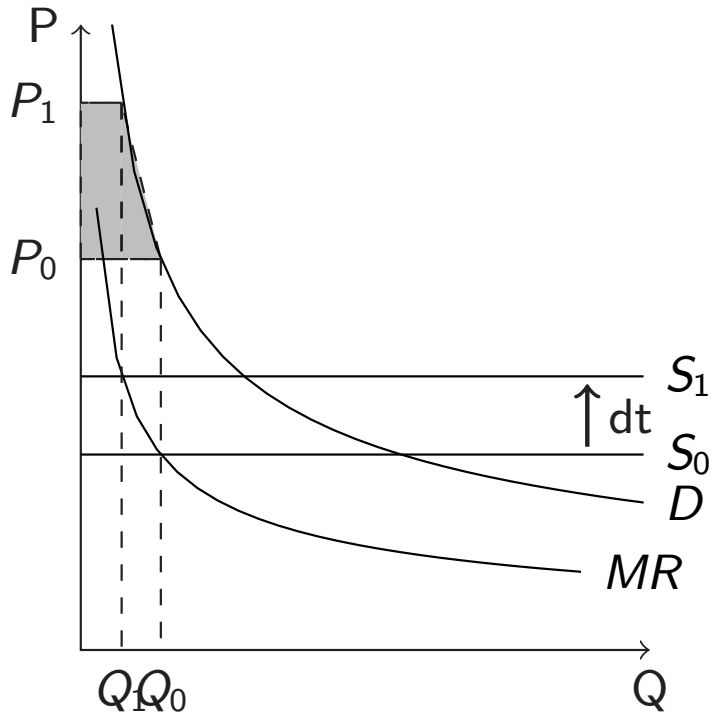
- Is there a behavioral explanation?

The possibility of $>$ 100% pass-through

A. Perfect Competition



B. Monopoly



▸ Back

The determinants of pass-through

Perfect competition

$$\frac{dp_c}{dc} = \frac{\epsilon_S}{\epsilon_S - \epsilon_D} = \frac{1}{1 - \frac{\epsilon_D}{\epsilon_S}}$$

Monopoly, constant MC

$$\frac{dp_m}{dc} = \frac{\frac{\partial p(q_m)}{\partial q_m}}{2\frac{\partial p(q_m)}{\partial q_m} + q_m \frac{\partial^2 p(q_m)}{\partial q_m^2}}$$

▸ Back

Characteristics of Spanish retail gas stations

	Urban	Rural
Retail price (c/L)	98.62	98.20
Brand		
Refiner	0.64	0.59
Wholesaler	0.16	0.13
Contract		
COCO	0.30	0.20
Commission contracted	0.29	0.32
Firm-sale contracted	0.18	0.16
Amenities		
Carwash	0.48	0.42
Tires and fluids	0.63	0.65
Convenience store	0.67	0.64
Cafeteria	0.15	0.18
N	3,605	5,852

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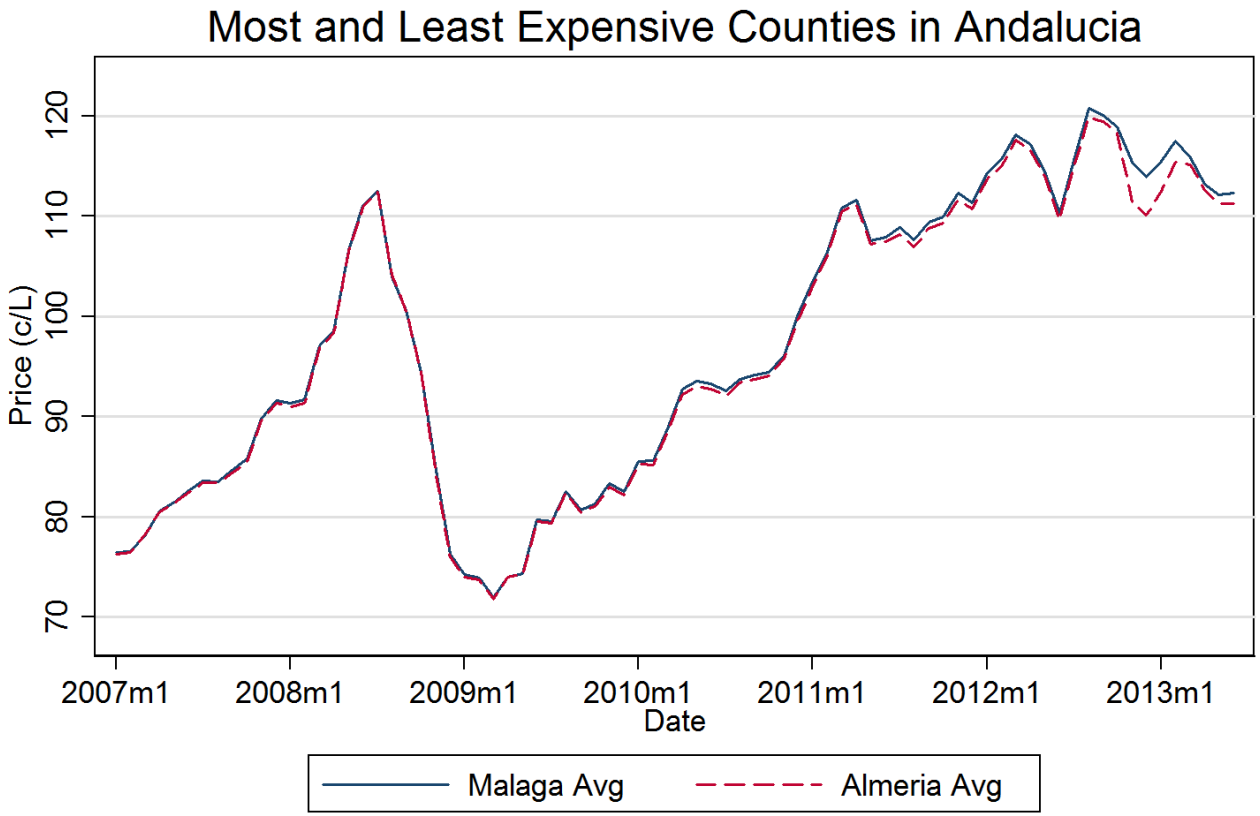
Characteristics of stations' surroundings

	Urban	Rural
Panel A. Competition measures		
# of rival stations within 5 minutes	3.53	1.27
Own-firm proportion	0.44	0.70
Panel B. Socioeconomic indicators		
Municipal population density (1000s/km^2)	2.36	0.26
Municipal mean house price (1000s of euros/m^2)	1.87	
Education: Some schooling, up to high school	0.12	0.16
Education: High school and/or professional degree	0.47	0.49
Education: Baccalaureate, master, or doctoral degree	0.18	0.11
N	3,605	5,852

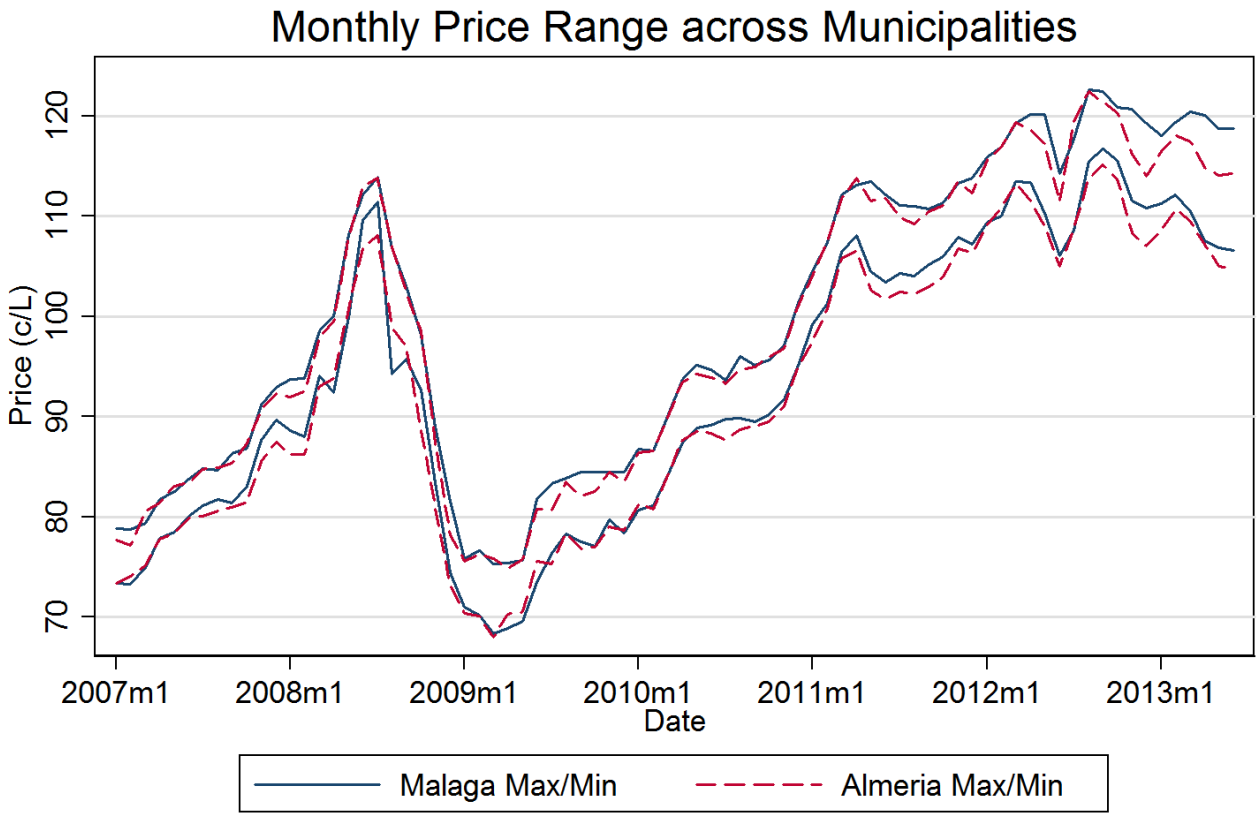
▸ Back

County-level price differences are negligible



▸ Within County ▸ Back

Municipality-level differences are *not* neglible



▸ Cross County ▸ Back

Assessing price trends around tax hikes

Event study model

$$P_{it} = \alpha + \sum_{j=a}^{b} \pi^j D_{st}^j + \mathbf{X}_{it}' \delta + \lambda_i + \sigma_t + \varepsilon_{it}$$

- Index j denotes a time period relative to the event of interest - a tax hike
  - D_{st}^j is a binary variable equaling one if time t is j periods (where $j \in [a, b]$) after a tax hike in state s
  - $[a, b] = [-12, 12]$; observation window is thus 6 months wide

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Empirical model of tax pass-through

Main fixed effects specification

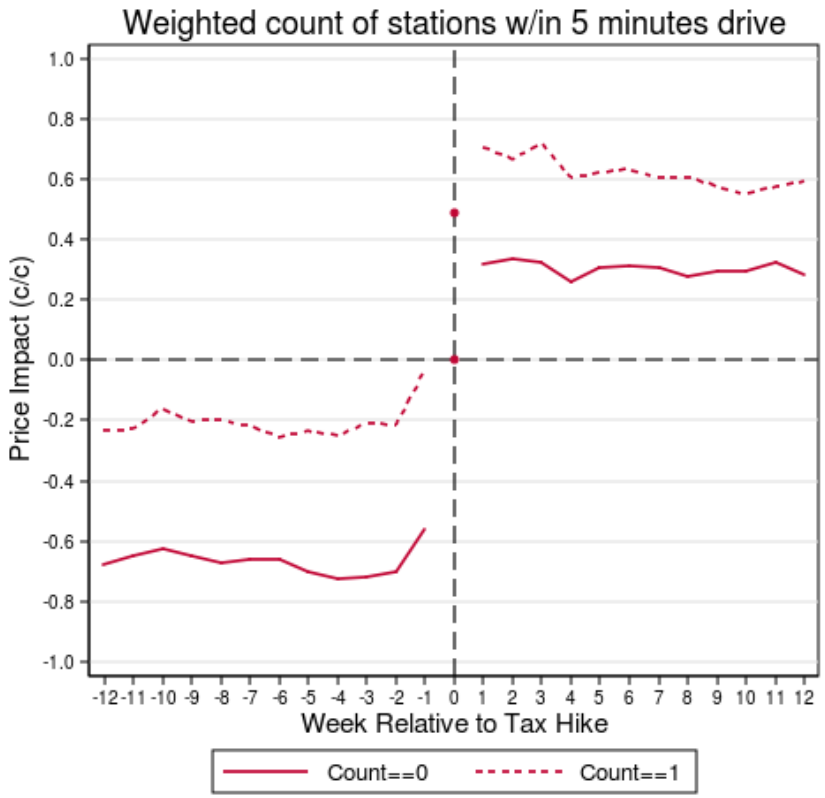
$$P_{it} = \alpha + \beta Tax_{st} + \mathbf{X}_{it}^{'}\delta + \lambda_i + \sigma_t + \varepsilon_{it}$$

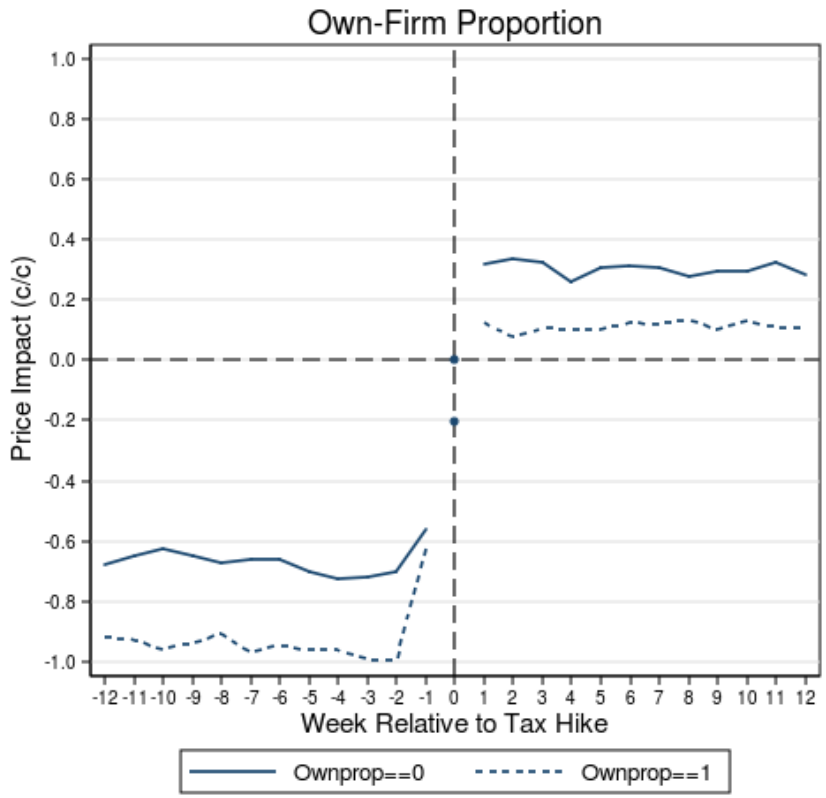
Adding interactions between the tax variable and local market characteristics:

$$P_{it} = \alpha + \beta Tax_{st} + \mathbf{X}_{it}^{'}\delta + \sum_{k=1}^{K}\left(\gamma_k Tax_{st} * X_{it}^{k}\right) + \lambda_i + \sigma_t + \varepsilon_{it}$$

▸ Back

Is pass-through heterogeneous?





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