EAGCP June Plenary meeting

COMPETITION AND PASS-THROUGH: EVIDENCE FROM THE GREEK ISLANDS

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Pass-through and Competition

- Understanding how firms pass cost shocks through to prices of fundamental importance across many fields
  - ✓ Public economics, international trade, productivity, IO (price discrimination, merger analysis, sectors: health, energy), macro (fiscal & monetary transmission)
- Theory: competition is a key determinant of pass-through
- Empirics: well-established research exploiting variability in costs (sales taxes, exchange rates, input prices) to infer the magnitude of the pass-through
- However, very little evidence how pass-through varies with competition
- Typically, number of competitors “located” nearby (arbitrary and problematic) with no attention to *market structure endogeneity*

This paper

- Think of the ideal experiment:
  - exogenous variation in market size,
  - significant and unexpected common shock, and,
  - good control for local market conditions (no way!)
- Welcome to Greece: where the impossible becomes reality!
  - ✓ Islands of different size (given by the God(s))
  - ✓ Financial crisis forces the government to raise taxes (three times!)
  - ✓ Government increases excise duty for all gasoline products *except* for heating diesel (deep down they are randomistas…)
- Our goal: measure how pass-through varies with competition in small isolated oligopolistic markets of different size
  - Heterogeneity across products (Unleaded 95 vs 100 vs Diesel)?
  - Different tax changes (three different changes in excise duties)?
  - Speed of adjustment?
  - Alternative market definitions?

Theory

Discussion based on Weyl and Fabinger (2013):

- Symmetric firms & perfect competition: $\rho = \frac{1}{1+\frac{\varepsilon_D}{\varepsilon_S}}$
- Monopoly : $\rho = \frac{1}{1+\frac{\varepsilon_D{}^{-1}}{\varepsilon_S}+\frac{1}{\varepsilon_{ms}}}$
- Symmetric imperfect competition: $\rho = \frac{1}{1+\frac{\theta}{\varepsilon_\theta}+\frac{\varepsilon_D-\theta}{\varepsilon_S}+\frac{\theta}{\varepsilon_{ms}}}$
- Asymmetric: same ideas, more complicated formula
- In general, the sign and magnitude of ↑ competition on pass-through is ambiguous.
- If $\begin{cases} mc\ constant \\ \theta\ constant \\ demand\ linear \end{cases}$ then $\rho = \frac{1}{1+\theta}$ as competition ↑, pass-through ↑

Industry background

- Petroleum industry: refineries→ wholesalers → retailers
- Taxation of petroleum products:

$$P_{retail} = (P_{refinery} + taxes\&fees + margins)(1 + VAT)$$

- Financial/debt crisis: significant increase in excise duties

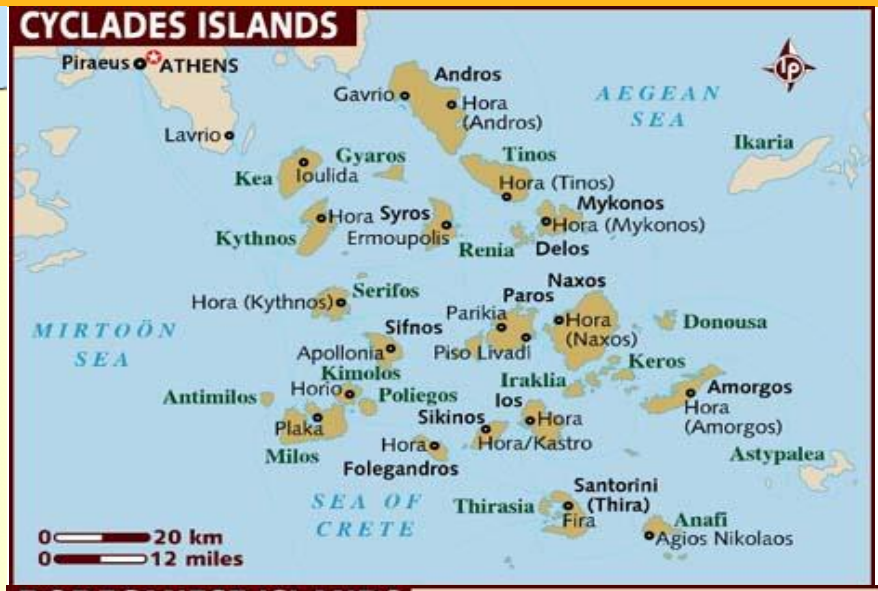
	Δunleaded	Δdiesel	Δsuper
9/2/2010	29%	17%	29%
4/3/2010	15%	9%	15%
3/5/2010	10%	8%	10%

- No change in excise duty for heating diesel (chemically identical to Diesel, just colored): control group

Data

- Daily station-level retail prices for all available gasoline products across Greek islands in 2010 from the Ministry of Development & Competitiveness (e-prices.gr)
- Socio-economic (education, income, tourists etc) and geographic (size, distance from Piraeus/land) characteristics of each island from the Hellenic Statistical Authority
- Geo-located each gas station and calculated distances
- Key: isolated markets with captive consumers

Greek islands



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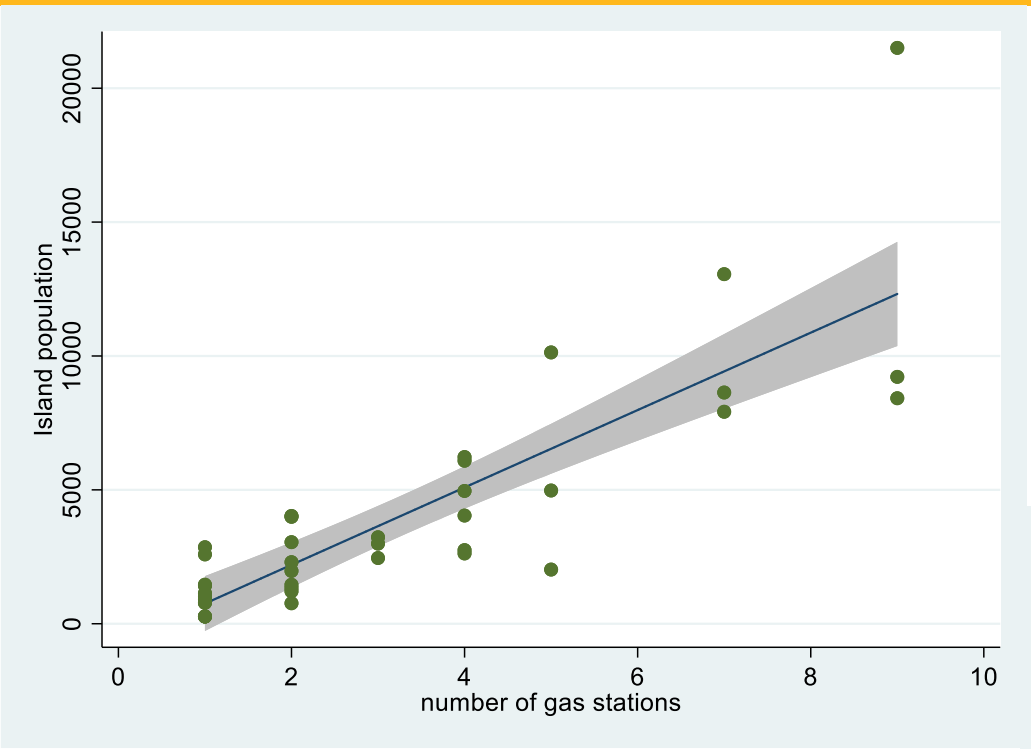
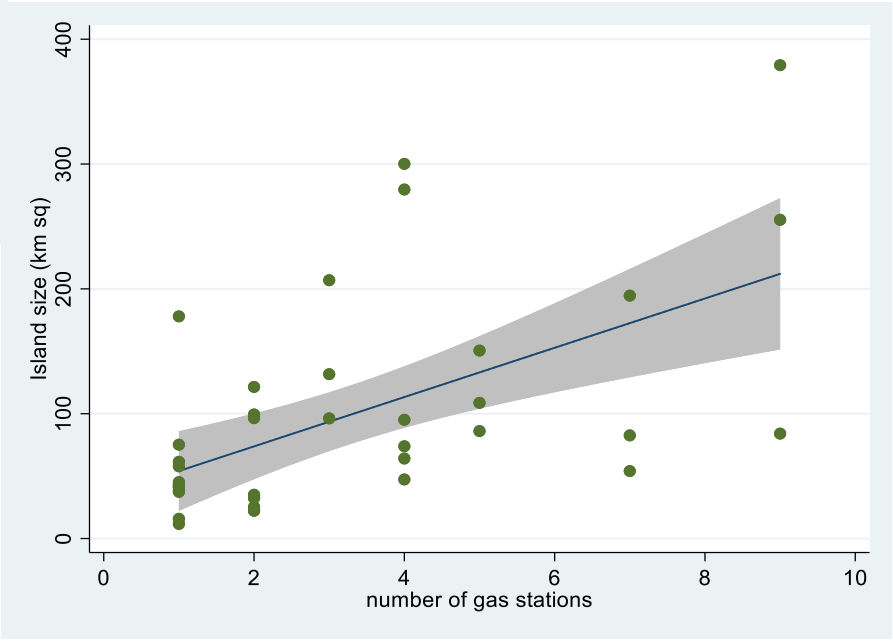
Competition and Market Size





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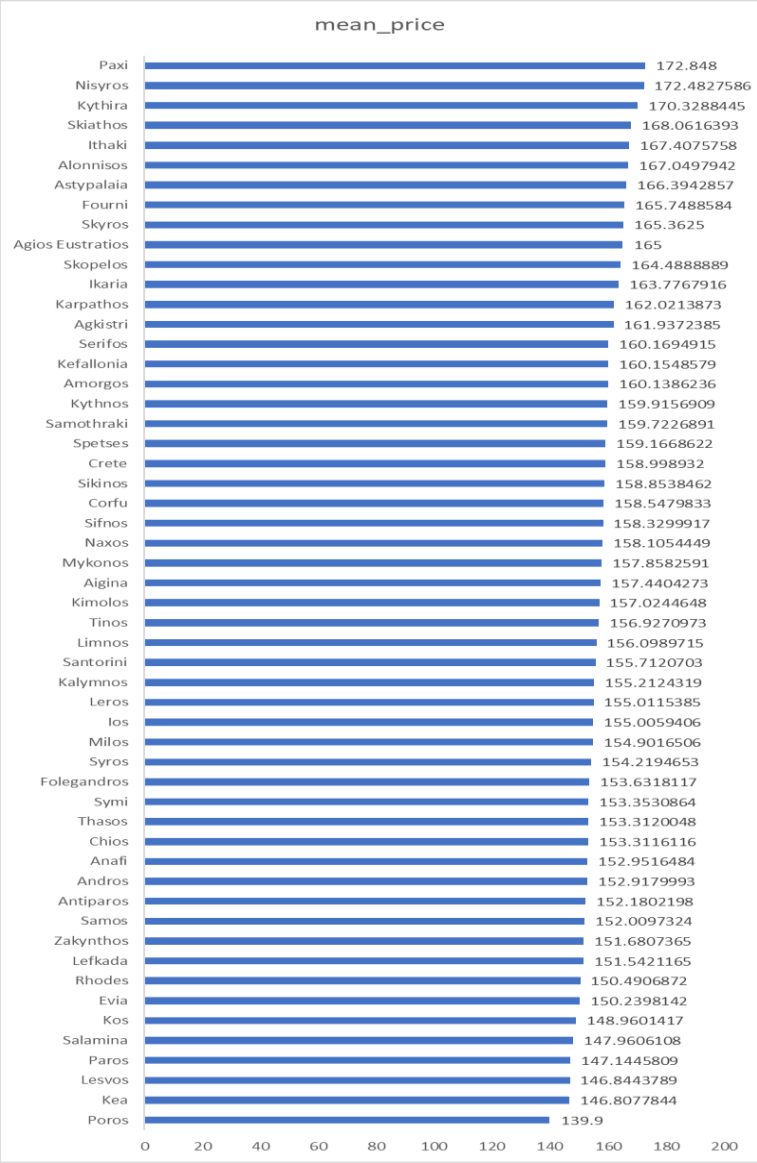
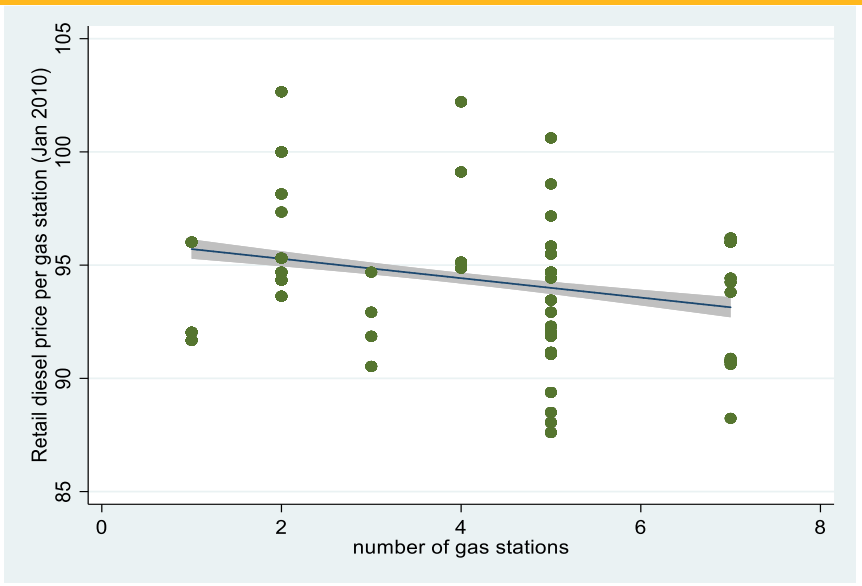
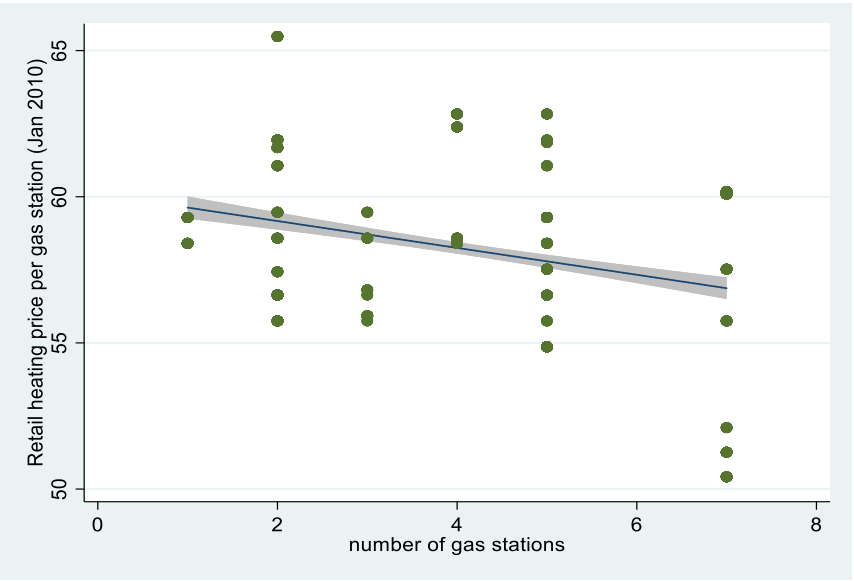
Competition and Prices







Methodology

- Difference-in-Differences framework:

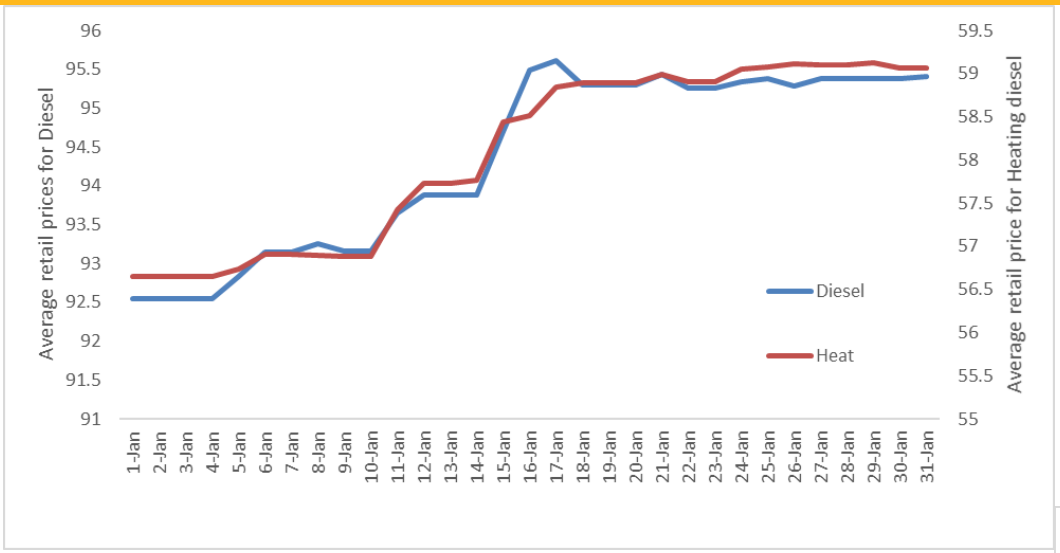
$$P_{kist} = \rho Tax_{kt} + \lambda_t + \lambda_{ks} + \varepsilon_{kist}$$

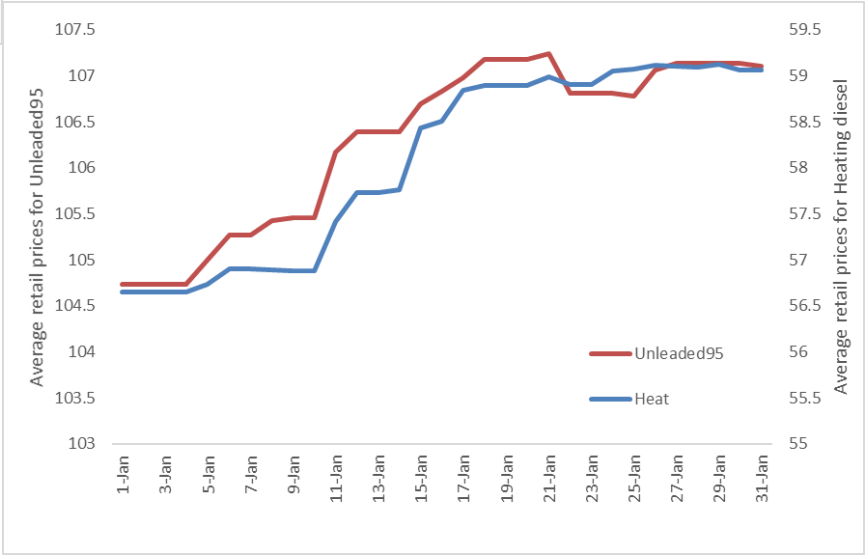
for product *k*, on island *i*, in gas station *s*, on day *t.*

- Time window: 10-day $\{\tau - 1, \tau + 10\}$
- Controls: product-station FE, day (doy) FE
- Standard errors clustered at the station level

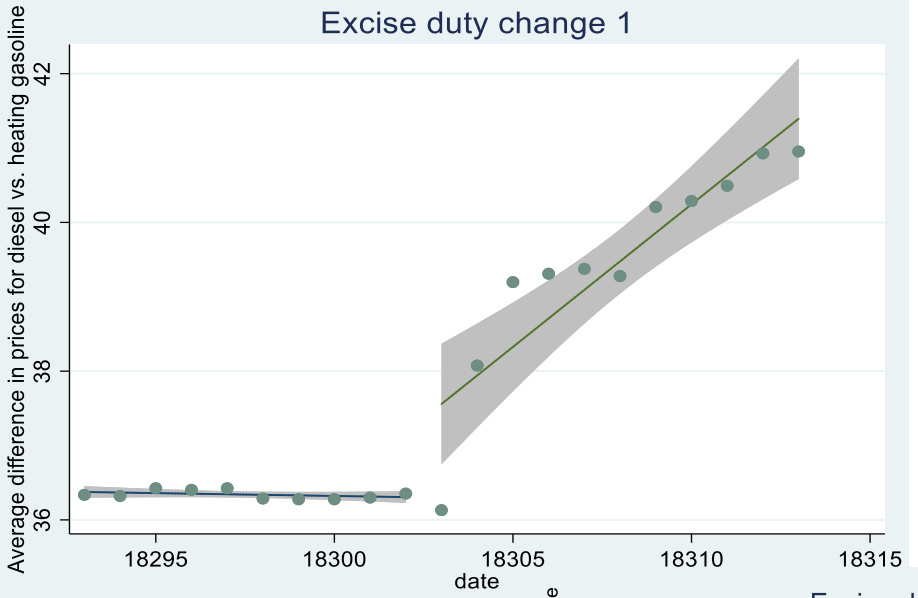
❖ **Identification**: control group (heating diesel) allows us to identify pass-through

Parallel Trends BEFORE any changes





DiD in pictures



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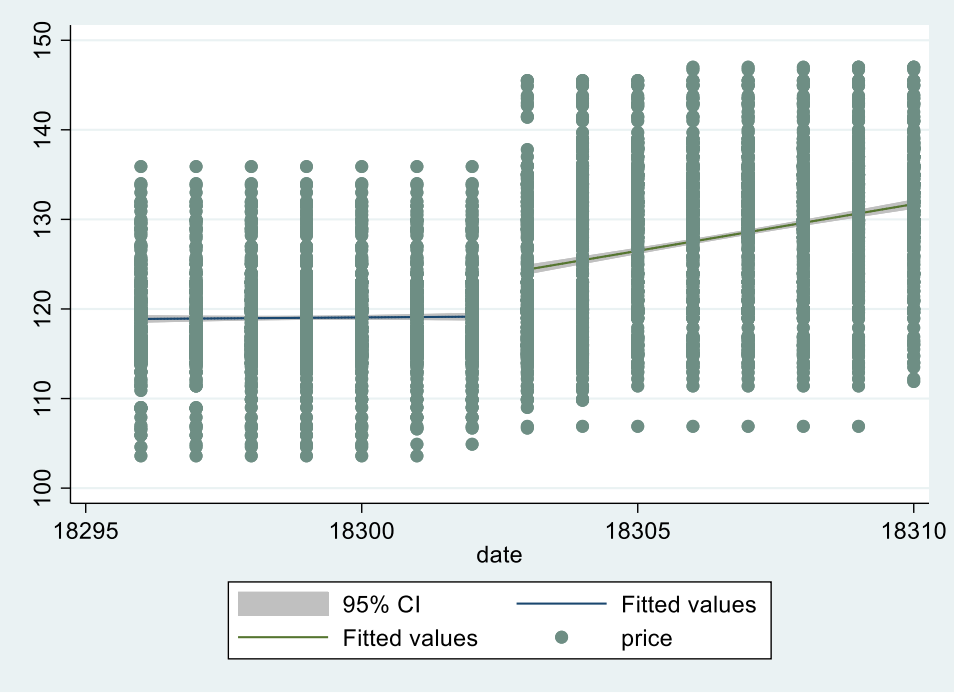
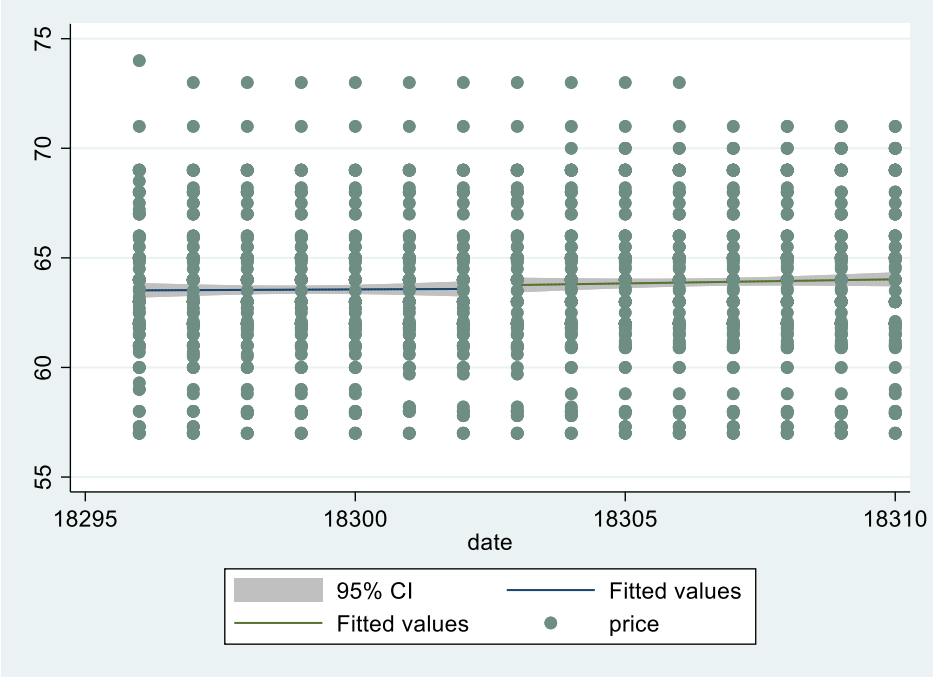
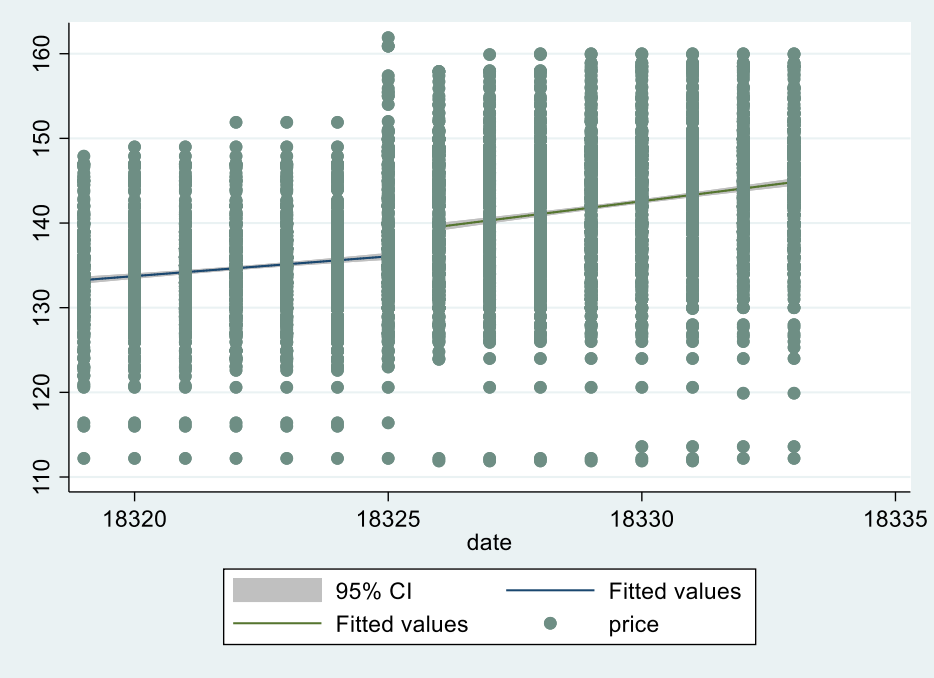
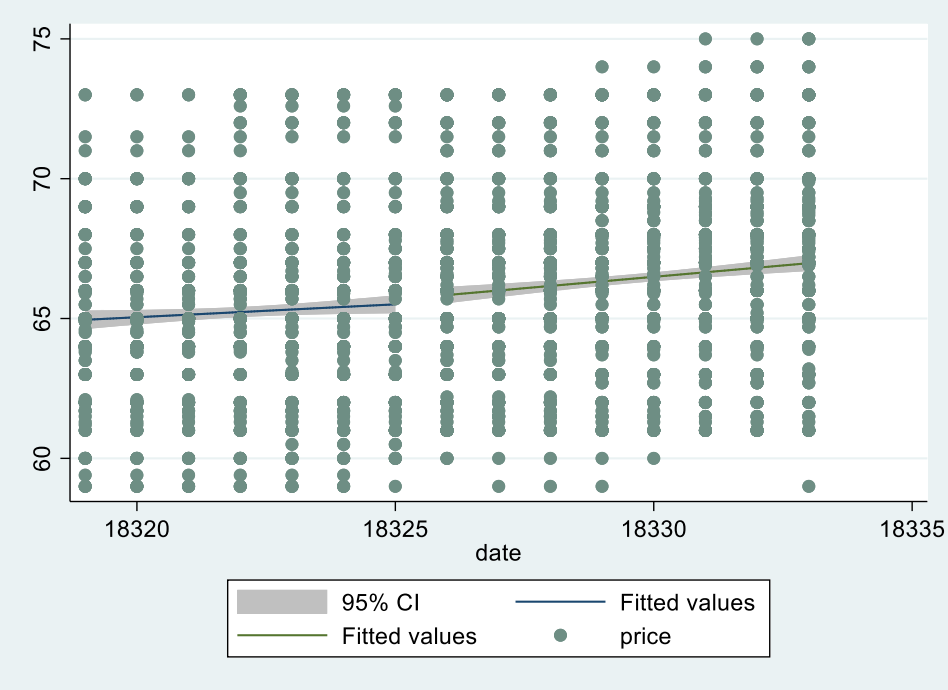
Treatment & Control (excise 1)



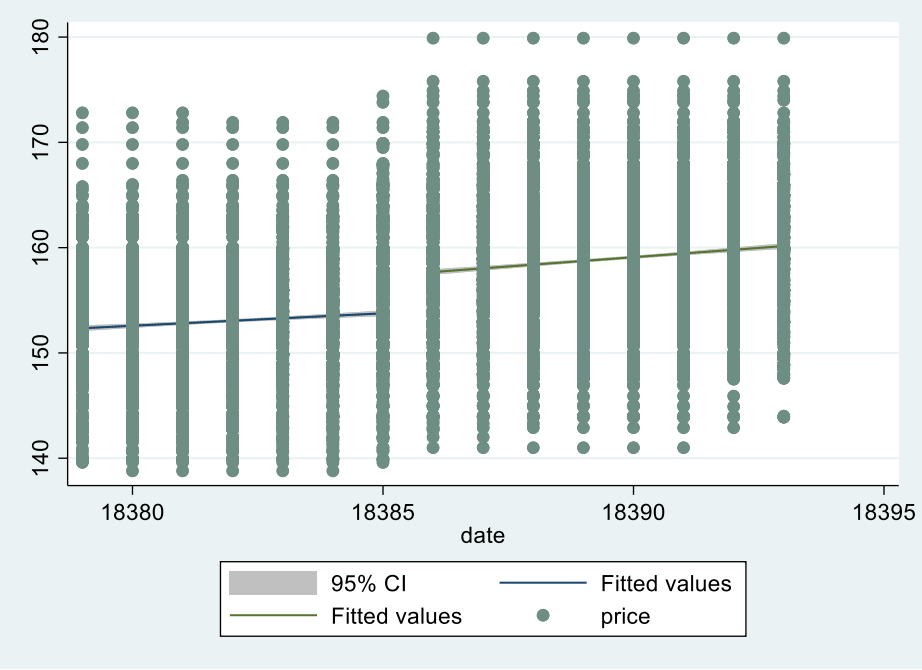


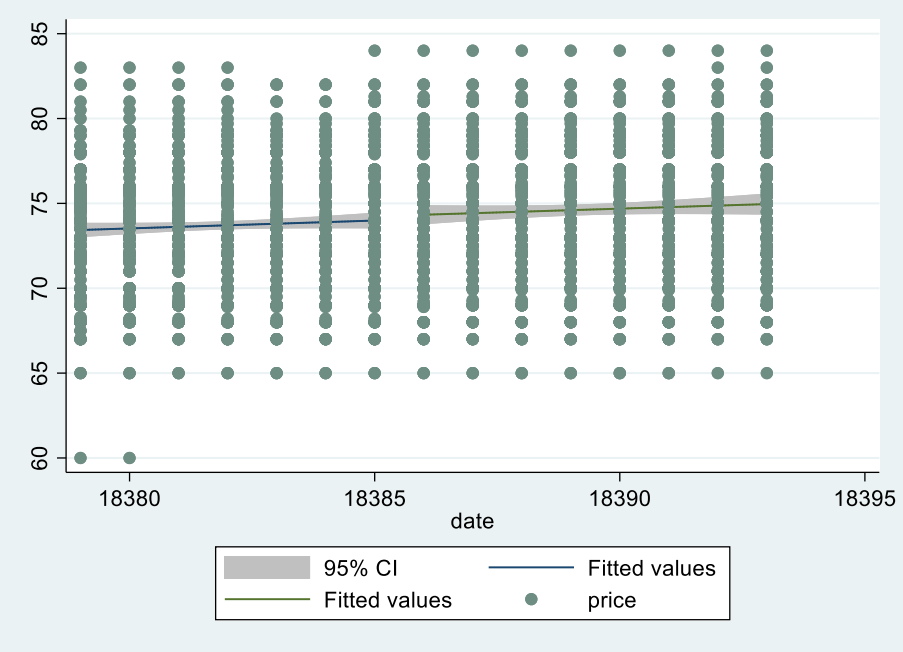
Treatment & Control (excise 2)





Treatment & Control (excise 3)





Result 1: almost complete overall pass-through

	3 days	7 days	10 days
excise change 1	49%	95%	96%
excise change 2	43%	69%	87%
excise change 3	77%	96%	97%
ALL	59%	88%	94%

Speed of adjustment

- Pass-through depends on **extensive** (how many stations adjusted their prices) and **intensive** (what was the size of the price change) margin.
- Long horizon → no difference, short horizon → BIG difference

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$
Sample	Excise 1	Excise 2	Excise 3	All excise episodes
Tax_{it}	0.690***	1.076***	0.661***	0.767***
	(0.087)	(0.111)	(0.097)	(0.069)
Observations	283	267	365	915
Within R^2	0.743	0.757	0.662	0.931
Clusters	37	41	55	57

- Conditional on changing prices pass-through 77% (63%-90%)
- No significant differences across excise incidents.

Methodology

- Difference-in-Differences framework:

$$P_{kist} = \rho(n_i, Z_i)Tax_{kt} + \lambda_t + \lambda_{ks} + \varepsilon_{kist}$$

for product *k*, on island *i*, in gas station *s*, on day *t.*

Interaction of Tax with n_i: number of competitors

- Alternatively, non-parametrically $\rho(n_i) = \sum_j \rho_j I(n_i = j)$

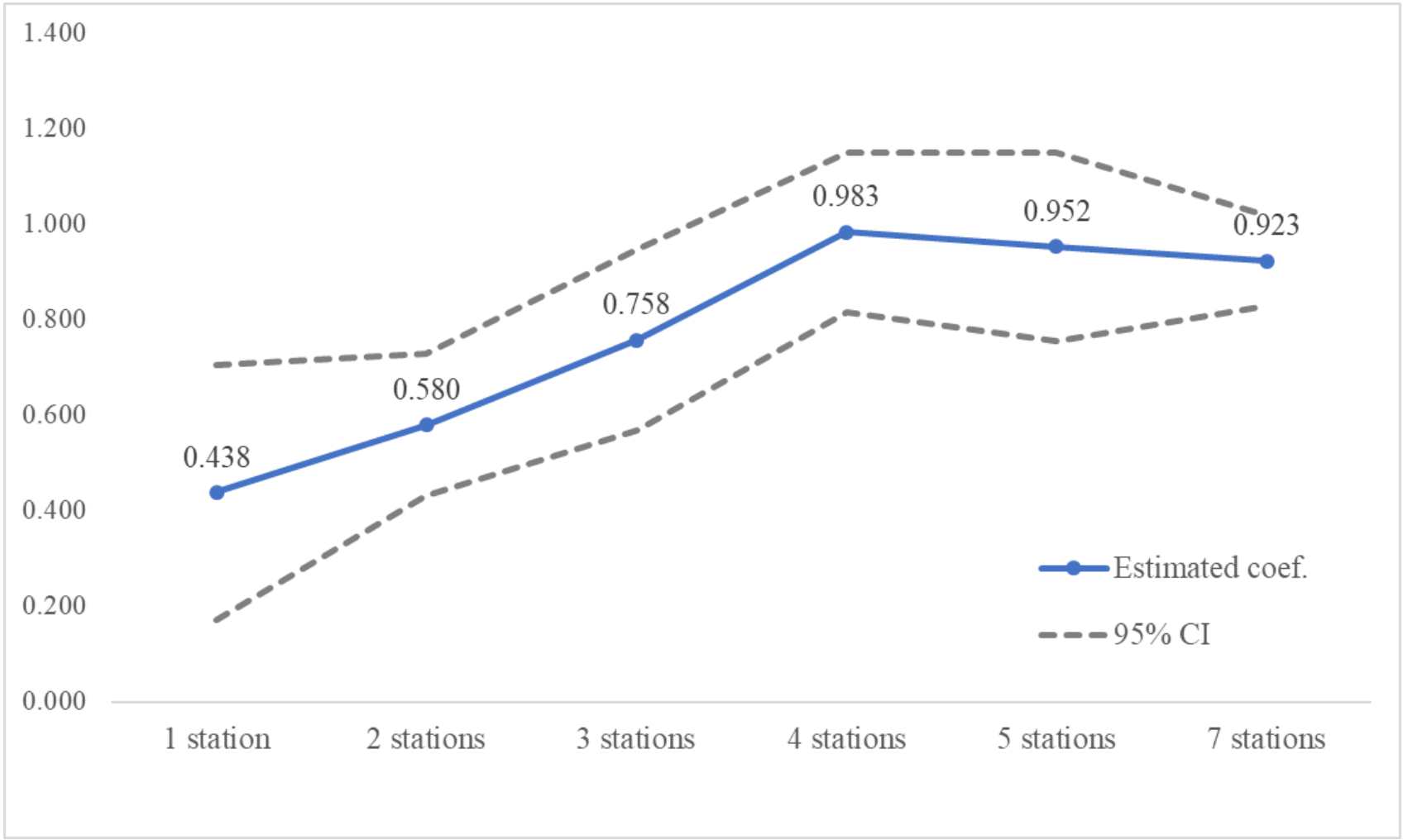
❖ **Identification**: variation of competition across islands

❖ Robustness: control for island characteristics (Z_i) and use island **population** as **IV**

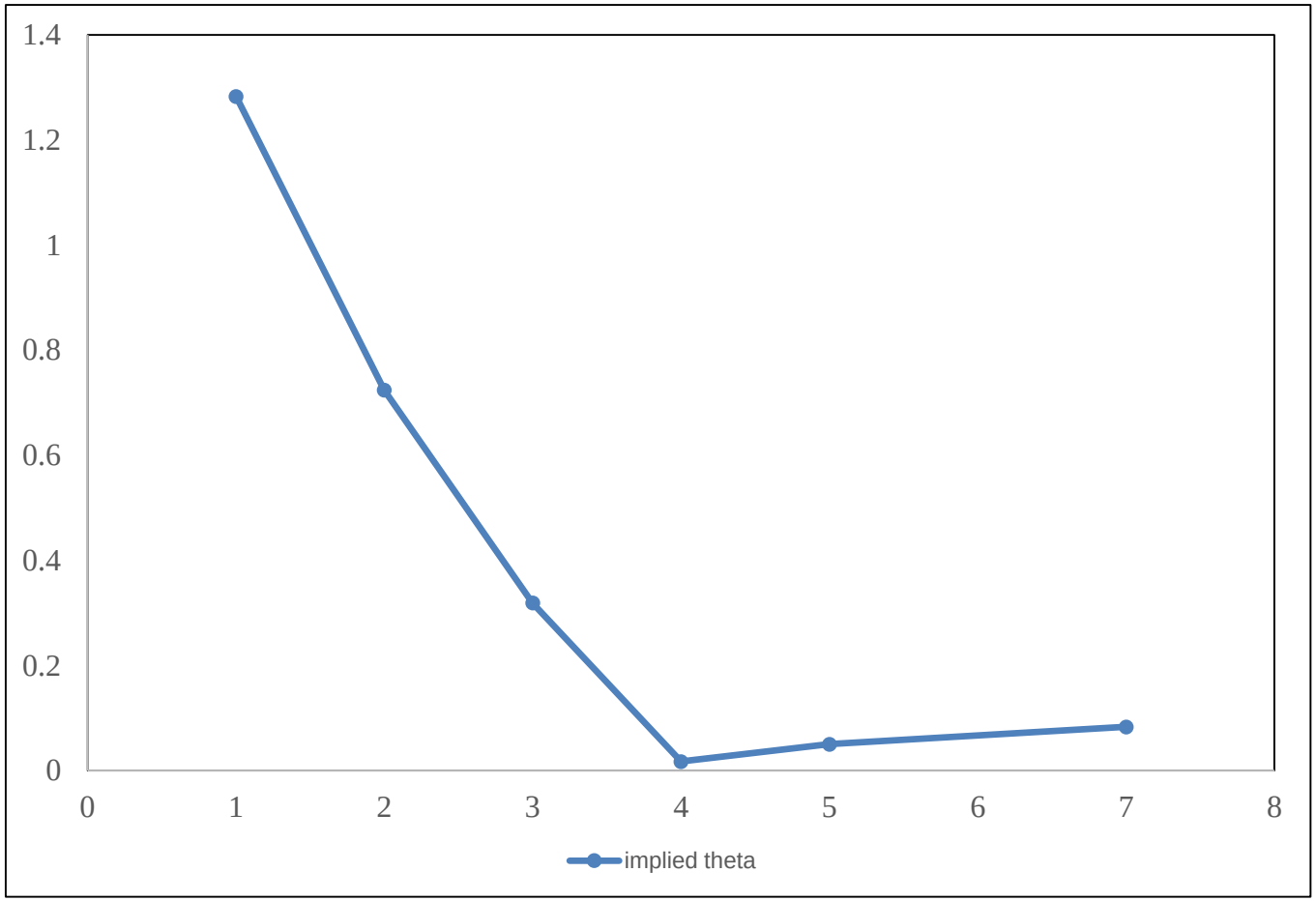
Result 2: positive & non-linear relationship between competition and pass-through

	(1)	(4)
Estimation method	FE	FE
Dependent variable	$Price_{ist}$	$Price_{ist}$
Sample	All excise episodes	All excise episodes
Tax_{it}	0.449***	0.139
	(0.091)	(0.186)
Tax_{it} × Number of competitors$_s$	0.086***	0.289***
	(0.020)	(0.100)
Tax_{it} × Number of competitors$_s^2$		-0.025**
		(0.011)
Observations	915	915
Within R^2	0.937	0.939
Clusters	57	57

Result 2: positive & non-linear relationship between competition and pass-through



Result 2: implied intensity of competition



- If we assume that demand is linear, then behavioral parameter $\theta = \frac{1-\rho}{\rho}$ can be recovered from estimated pass-through.
- Degree of market power sharply decreases and gets very close to zero with ≥ 4 firms (similar to Bresnahan and Reiss, 1991).

Robustness: controlling for island characteristics and IV

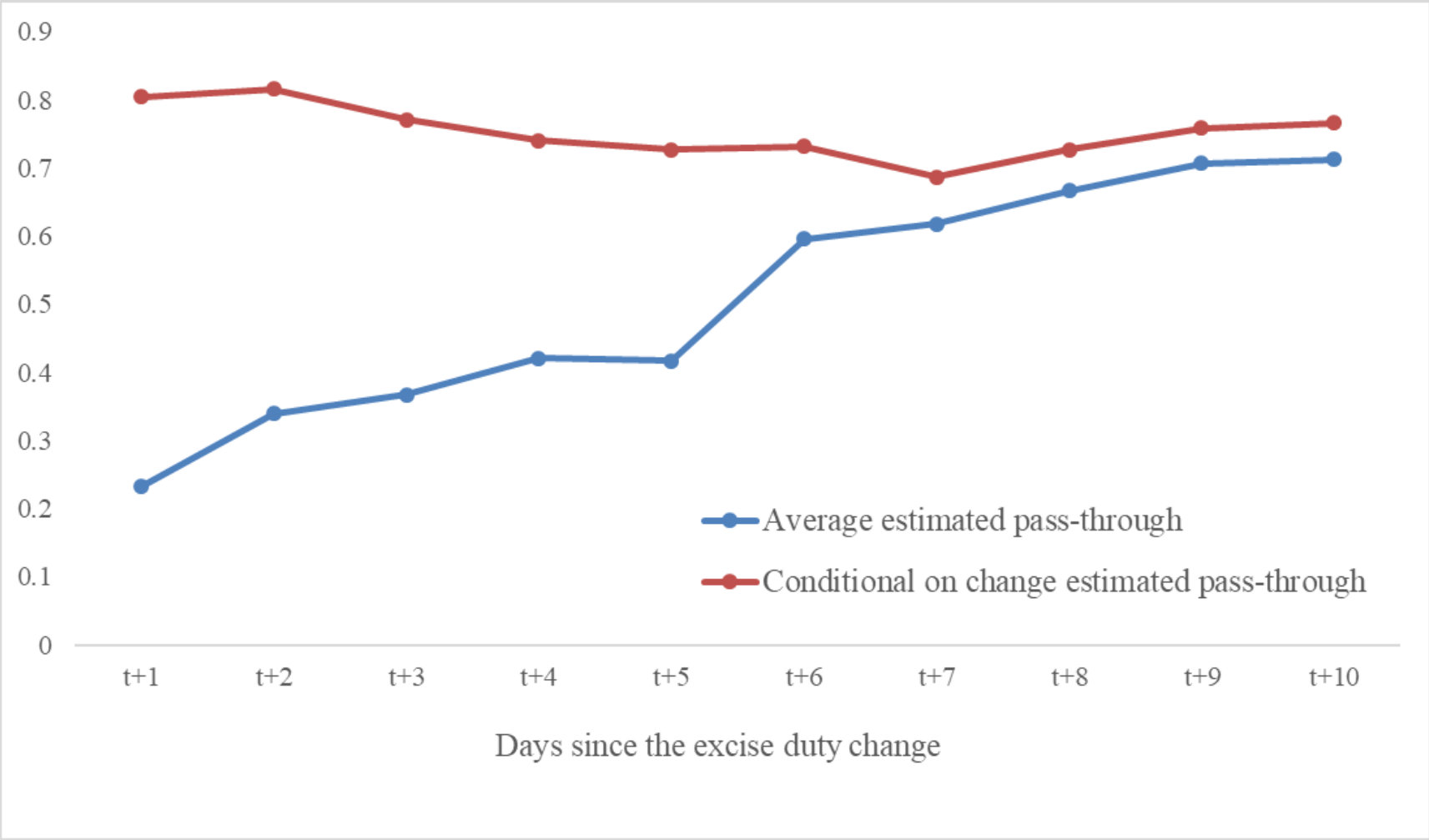
	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	FE	FE	IV	FE	FE	IV
Dependent variable	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$	$Price_{ist}$
Sample	All excise episodes	All excise episodes	All excise episodes	All excise episodes	All excise episodes	All excise episodes
Tax_{it}	0.449***	-0.833	0.464***	0.139	-0.601	-0.702
	(0.091)	(0.689)	(0.104)	(0.186)	(0.897)	(0.466)
Tax_{it} × Number of competitors$_s$	0.086***	0.083**	0.082***	0.289***	0.265	0.821***
	(0.020)	(0.031)	(0.020)	(0.100)	(0.172)	(0.294)
Tax_{it} × Number of competitors$_s^2$				-0.025**	-0.023	-0.090**
				(0.011)	(0.018)	(0.037)
		Additional controls include interactions with income, education, number of ports, and airports, distance from Piraeus and tourist arrivals.			Additional controls include interactions with income, education, number of ports, and airports, distance from Piraeus and tourist arrivals.	
Instruments						
First Stage Coef. Population			0.513***			1.149***
			(0.069)			(0.101)
First Stage Coef. Population^2						-0.057***
						(0.010)
First Stage F-test for Number of competitors			54.63***			108.01***
			[0.000]			*[0.000]*
First Stage Coef. Population						8.246***
						(1.131)
First Stage Coef. Population^2						-0.358***
						(0.100)
First Stage F-test for Number of competitors^2						42.01***
						[0.000]

Pass-through and speed of adjustment

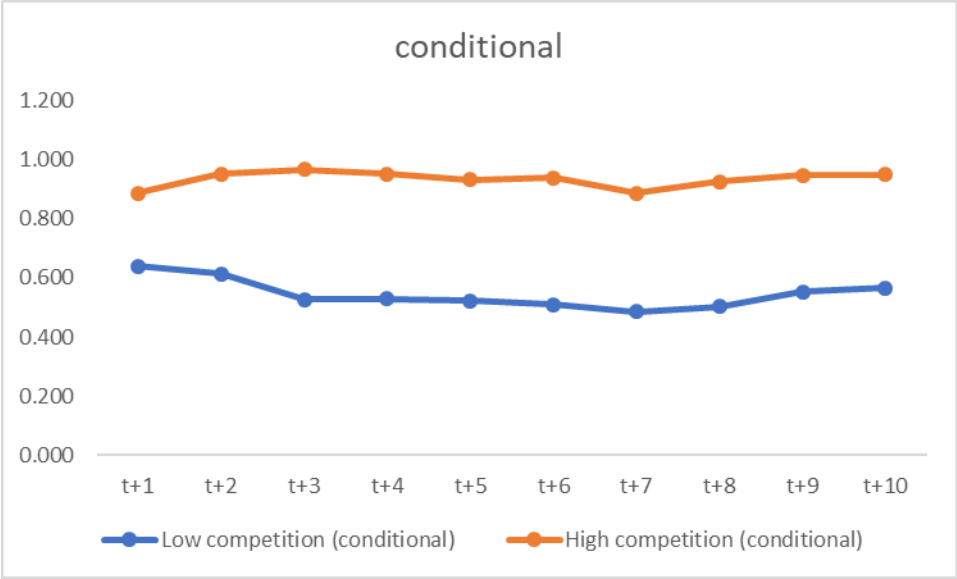
- How does the adjustment varies over time?
  - **Conditional** pass-through: conditional on changing prices what was the size of the price change (intensive margin)
  - **Average** pass-through: pool all stations together independent of whether they adjusted their prices or not (extensive margin)
  - Long horizon → no difference,
    short horizon → BIG difference

- Does the speed of adjustment depend on competition?
  - Frequency of changes vs. magnitude of changes

Result 3: Pass-through and speed of adjustment

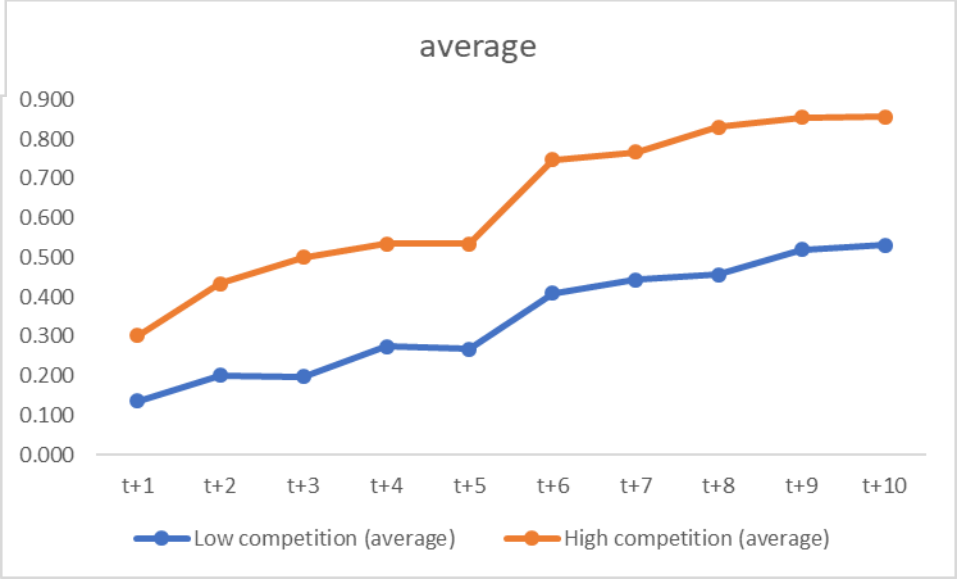


Result 3: Competition and speed of adjustment

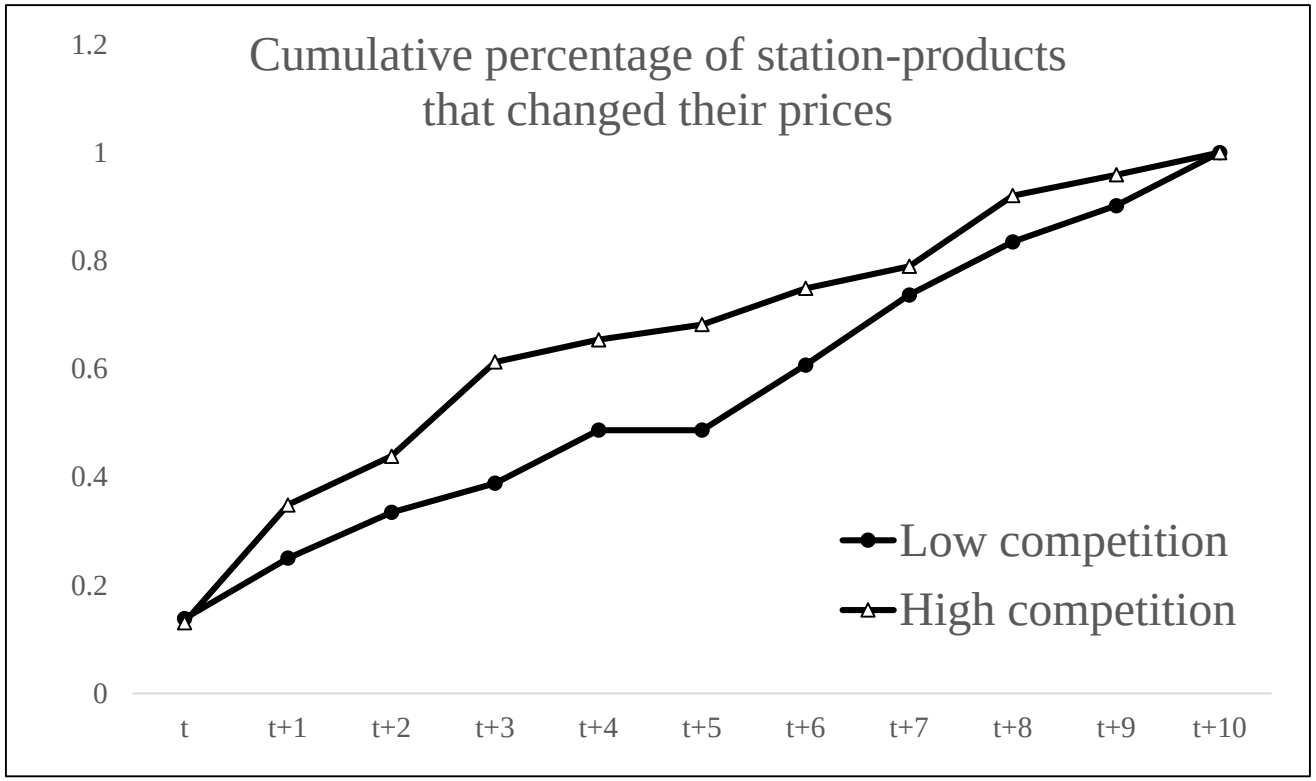


The conditional pass-through is stable and significantly higher in islands with more competitors.

The average pass-through is significantly higher in islands with more competitors.
At t+1 about double
At t+10 about 60% higher



Competition and frequency of changes

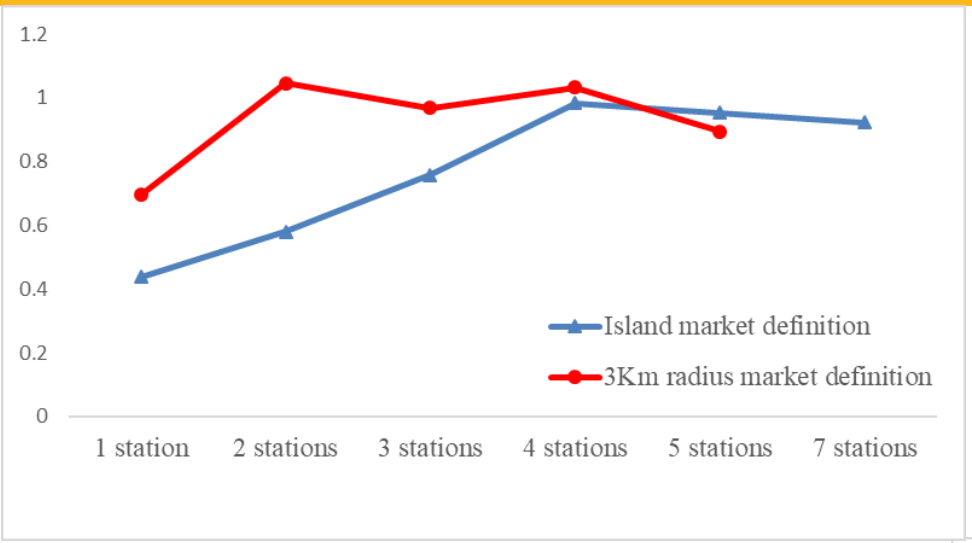


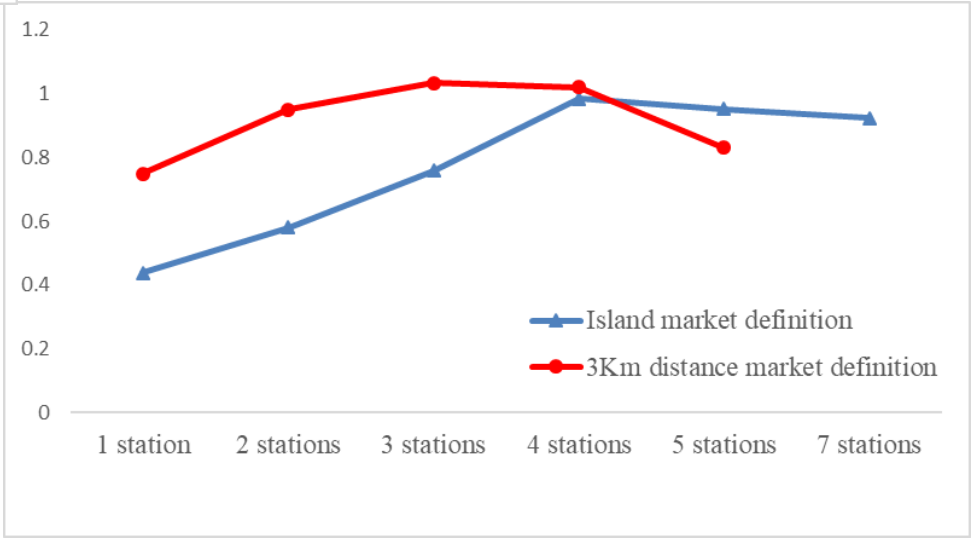
More competitive markets adjust faster to cost shocks because price adjustments are larger AND more frequent! (Gopinath and Itskhoki, 2010)

Geographic market definition

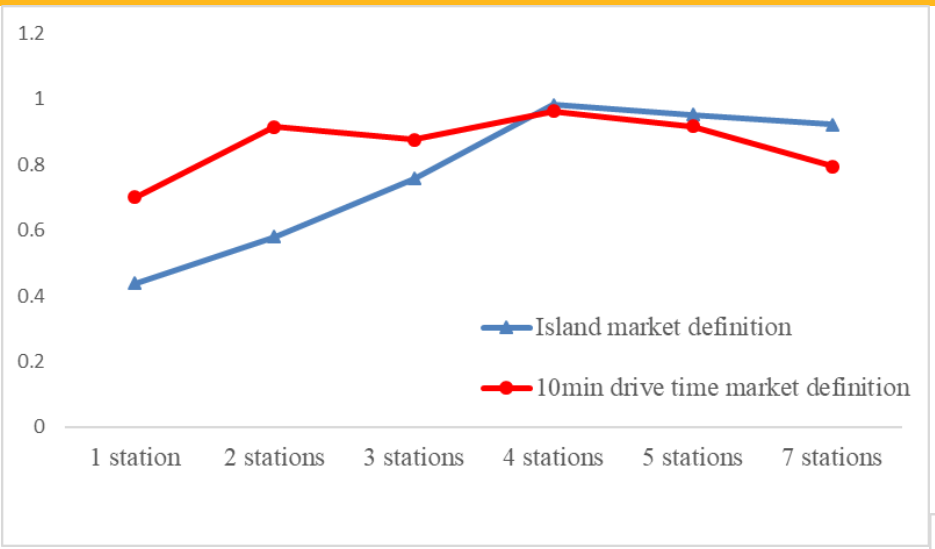
- What is the right geographical market definition?
- With no clear definition of market boundaries or detailed traffic data, researchers and policy makers define markets based on ***arbitrary distances*** across gas stations:
  - ✓ 3-kilometer radius
  - ✓ 3-kilometer (or 5-kilometer) distance (road structure)
  - ✓ 5-minute (or 10-minute) drive time (road structure + geography)
- We apply these arbitrary geographical market definitions and compare them with “our” island market definition

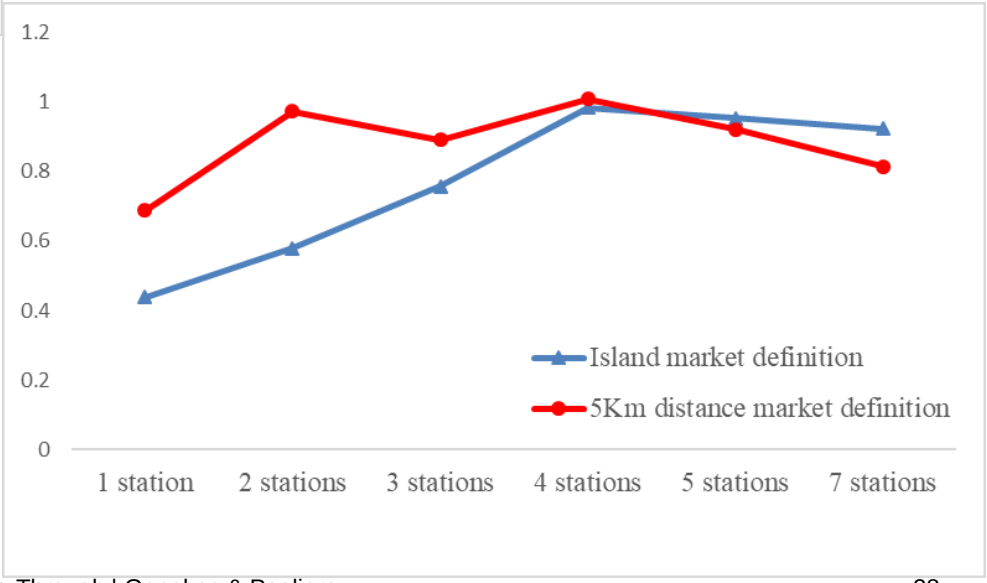
Result 4: Pass-through overestimation





Result 4: Pass-through overestimation





Conclusions

- ✓ First systematic examination of how pass-through varies with competition in isolated markets with captive consumers.
- ✓ Unique market set-up: exogenous market structure, unexpected and large changes in excise duties, good exogenous control group.
- ✓ Main results:

1) **pass-through increases with competition in a non-linear fashion**, going from 44% in a monopoly to 100% in markets for ≥ 4 competitors.

2) **Speed of adjustment is faster in more competitive markets,** both due to the size AND the frequency of changes.

3) **Conventional market definitions** based on distance between sellers **overestimate the pass-though** for markets with up to 3 competitors.

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