WHAT IS THE “RIGHT” GEOGRAPHIC MARKET DEFINITION?

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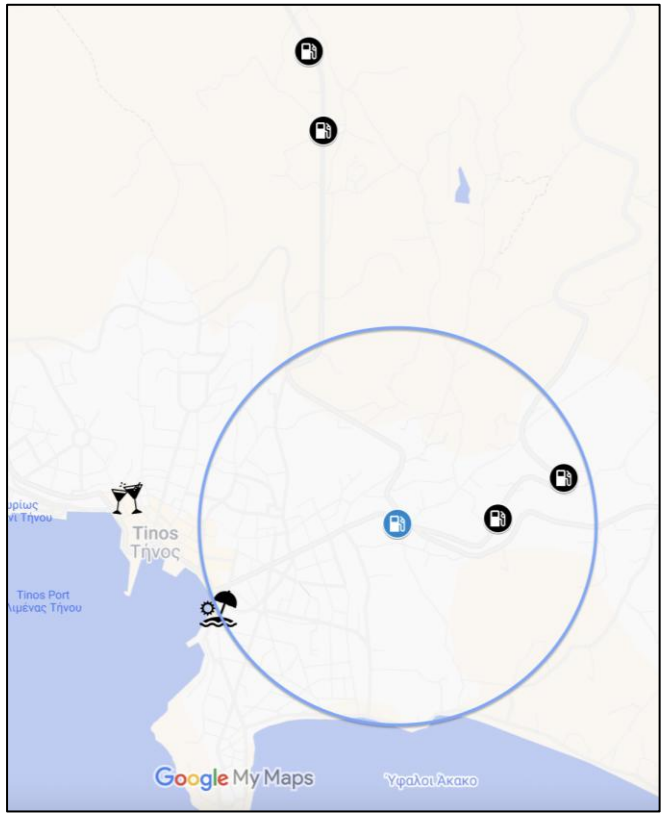
What is a Geographic market?

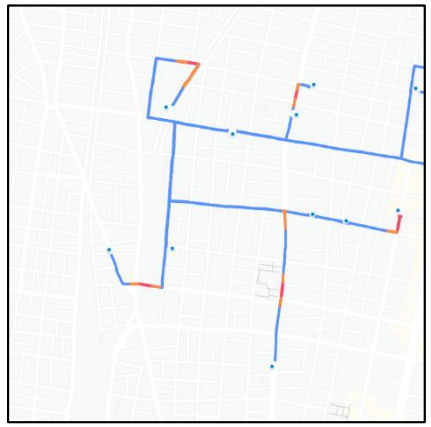
The area relevant to the assessment of the conduct constitutes the geographic dimension of a relevant (antitrust) market. … While the exact definition of a geographic market shows some variation between jurisdictions, many systems of competition law use the concept to identify the geographic boundaries of competition.

- João Azevedo, Jani Ringborg, Geographic market, Competition Law Dictionary, Concurrences, Art. N° 86379



Existing Approaches to Geographic Market Definition

- Iso-distance: define markets using fixed-radius circles (e.g., 500m around each station)
- Iso-chrone: use road distance or travel time to define accessible markets



- Price-based tests: Examine price co-movements across areas to detect market integration
- Mobility-aware models: Account for commuting flows and multiple origin points (Davis, 2006; Houde, 2012; Pennerstorfer et al., 2020)

Examples

- The Notifying Party suggests, … to split retail stations in three groups (city, suburban and rural) depending on the area type in which they are located and define separate catchment area radii per area type of the station based on driving distances (2.5 km, 5 km, and 20 km, respectively).

  https://ec.europa.eu/competition/mergers/cases1/202121/m9014_8817_6.pdf

- The Federal Cartel Office of Germany concludes that a radius of 25 km around the gasoline station in question is sucient to define the relevant market. … For rural areas a driving time of 60 minutes is assumed and for urban areas a driving time of 30 minutes.

  Bantle, Melissa; Muijs, Matthias; Dewenter, Ralf (2018) : A new price test in geographic market definition: An application to German retail gasoline market

Why Geographic market definition matters

- Accurate geographic definitions are crucial for antitrust enforcement and merger review.
- Spatial competition is central in retail markets (e.g., supermarkets, pharmacies, etc.).
- Central question: How does geography limit consumers' ability and willingness to substitute?
- Market boundaries depend on: consumer preferences,
  transportation and search costs,
  access to information.
- The problem: Standard definitions often rely on arbitrary distance cutoffs, ignoring real substitution patterns and the endogeneity of market structure

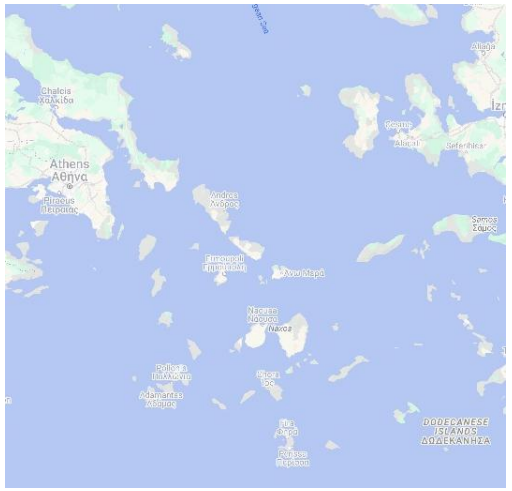
This paper

And now, for something different…

- Define different local markets based on different measurements

- Use a natural experiment to study how tax pass-through varies with local competition:
  - Three significant and unexpected tax hikes in gasoline products in 2010 (Unleaded95, Unleaded100, Diesel, Super)
  - Good control for local market conditions (Heating diesel)

- Benchmark our results using clearly separated markets:
  - Greek islands: clearly defined markets with isolated customers
  - Markets of different sizes give us exogenous variation in market structure
  - Use Genakos and Pagliero (2022) measure of how pass-through varies with competition: same natural experiment on islands
    → pass-through converges to unity with competition (consistent with theory)



This paper's Idea

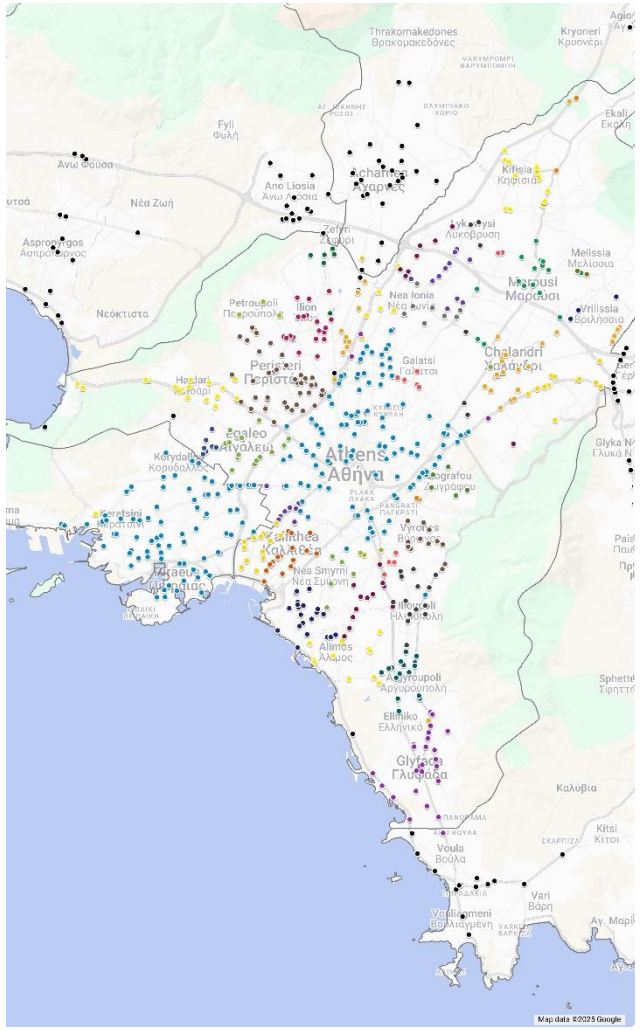
1. Define local markets in Athens metropolitan area
   - X-m radius (geography)
   - X-km driving distance (road network)
   - X-min drive time (road network + congestion)

2. For each definition:
   – Count number of nearby competitors
   – Estimate pass-through of excise tax shocks

3. Compare:
   – Theoretical predictions on how pass-through varies with competition in Athens
   – Against the benchmark from Greek islands (true isolated markets)

Athens: The Urban Test Case

- Why Athens?
  - Capital and largest urban area in Greece
  - Dense, complex road network
  - High potential for overlapping local markets
- Why it matters:
  - In urban settings, standard distance-based definitions of markets are especially problematic —Substitutability across locations is harder to pin down.
- Our question:
  - How should we define local markets in a city like Athens?
  - What definition — radius, drive distance, or time — best captures actual competitive pressure… if any?



Theory

Discussion based on Adachi & Fabinger (2022):

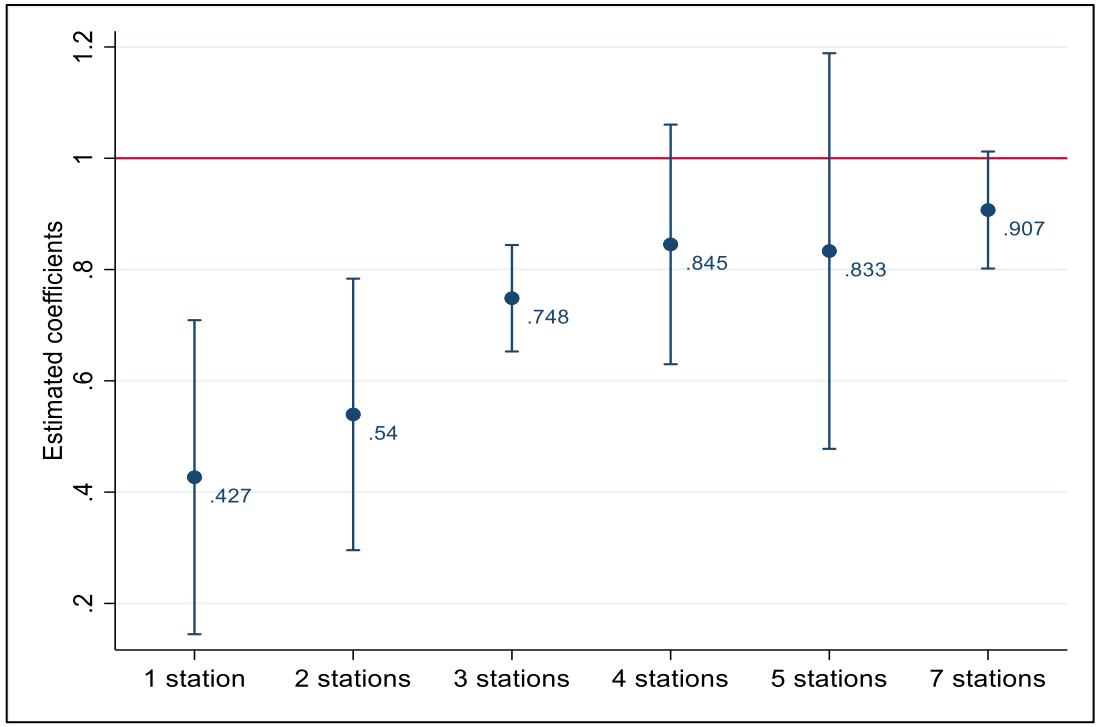
- Symmetric firms & imperfect competition: $\rho_t = \frac{1}{1+((1-\tau)\varepsilon-\theta)\chi+\frac{\theta}{\varepsilon_\theta}+\frac{\theta}{\varepsilon_{ms}}}$

where, conduct parameter θ measures the degree of competition, χ is the elasticity of the marginal cost with respect to quantity, ϵ_θ is the elasticity of the conduct parameter and ϵ_{ms} is the elasticity of the inverse marginal consumer surplus (or the curvature of the demand function).

- In general, the sign and magnitude of competition on pass-through is ambiguous.
- If $\begin{cases}\text{mc constant}\\ \theta \text{ constant}\end{cases}$ then $\rho_t = \frac{1}{1+\frac{\theta}{\varepsilon_{ms}}}$, meaning as competition ↑ : θ ↓ , pass-through → 1
- More generally, pass-through would *deviate* from one in an environment where firms have significant market power and would converge *towards* one otherwise, either from above or below unity.

Benchmark

Greek islands: Positive & non-linear relationship on competition & pass-through



Other examples

- … competition should lessen pass-through if, as we estimate, pass through exceeds unity. Columns (i)—(vi) use different measures of domestic competition and consistently supports that competition lessens

  Miller, N. H., Osborne, M., & Sheu, G. (2017). Pass-through in a concentrated industry: empirical evidence and regulatory implications. *The RAND Journal of Economics*, *48*(1), 69–93.

- The potential for a lack of 'full shifting' of the tax onto consumers is consistent with less competitive markets …

  Joseph J. Doyle, Krislert Samphantharak, $2.00 Gas! Studying the effects of a gas tax moratorium, Journal of Public Economics, Volume 92, Issues 3–4, 2008

- … the empirical evidence indicates that the VAT pass-through increases with competition, as predicted in the theory …

  Lydia Dimitrakopoulou, Christos Genakos, Themistoklis Kampouris, Stella Papadokonstantaki, VAT pass-through and competition: Evidence from the Greek islands, International Journal of Industrial Organization, Volume 97, 2024

Data

- Gasoline price data:
  - Daily station-level retail prices in Athens metro area, 2010
  - Covers all gasoline products (Unleaded95, Unleaded100, Diesel, Super, Heating Diesel)
  - Source: Greek Ministry of Development & Competitiveness
- Station-level geography:
  - Each station geo-located using official records + Google Maps
  - For each station, we define local markets using:
    - Isodistance: X-m radius
    - Driving distance: X-km road network
    - Isochrone: X-minute drive time
- Key question: What is the “right” geographic definition such that pass-through by number of competitors in Athens matches either the theoretical or empirical benchmark pattern from the islands?

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

TABLE 1 - EXCISE DUTY TAX CHANGES (Δ%)

Type of energy product	(1) Unleaded 95	(2) Unleaded 100	(3) Diesel	(4) Super (leaded)	(5) Heating diesel
10-Feb-10	(29%)	(29%)	(17%)	(29%)	(0%)
04-Mar-10	(15%)	(15%)	(9%)	(15%)	(0%)
03-May-10	(10%)	(10%)	(8%)	(10%)	(0%)

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

Geographic market definition

TABLE 3.1: MARKET DEFINITION AND COMPETITION BASED ON RADIUS

Radius	100m	300m	500m	1000m	1500m
1 competitor	405	195	68	4	6
2 competitors	85	174	117	16	1
3 competitors	6	86	121	25	4
4 competitors		31	83	16	
5 competitors		10	44	20	10
6 competitors			40	37	6
7+ competitors			23	378	469

TABLE 3.2: MARKET DEFINITION AND COMPETITION BASED ON DRIVING DISTANCE

Driving Distance	0.1km	0.3km	0.5km	1.0km	1.5km
1 competitor	466	379	256	53	12
2 competitors	30	99	151	89	21
3 competitors		17	71	77	27
4 competitors		1	12	88	28
5 competitors			6	77	33
6 competitors				50	44
7+ competitors				62	331

TABLE 3.3: MARKET DEFINITION AND COMPETITION BASED ON DRIVING TIME

Driving time	1min	2min	3min	4min	5min
1 competitor	352	167	47	15	6
2 competitors	110	160	74	31	12
3 competitors	26	95	99	50	12
4 competitors	8	43	88	37	25
5 competitors		19	76	57	25
6 competitors		7	52	62	28
7+ competitors		5	74	244	388

Methodology

- Difference-in-Differences framework:

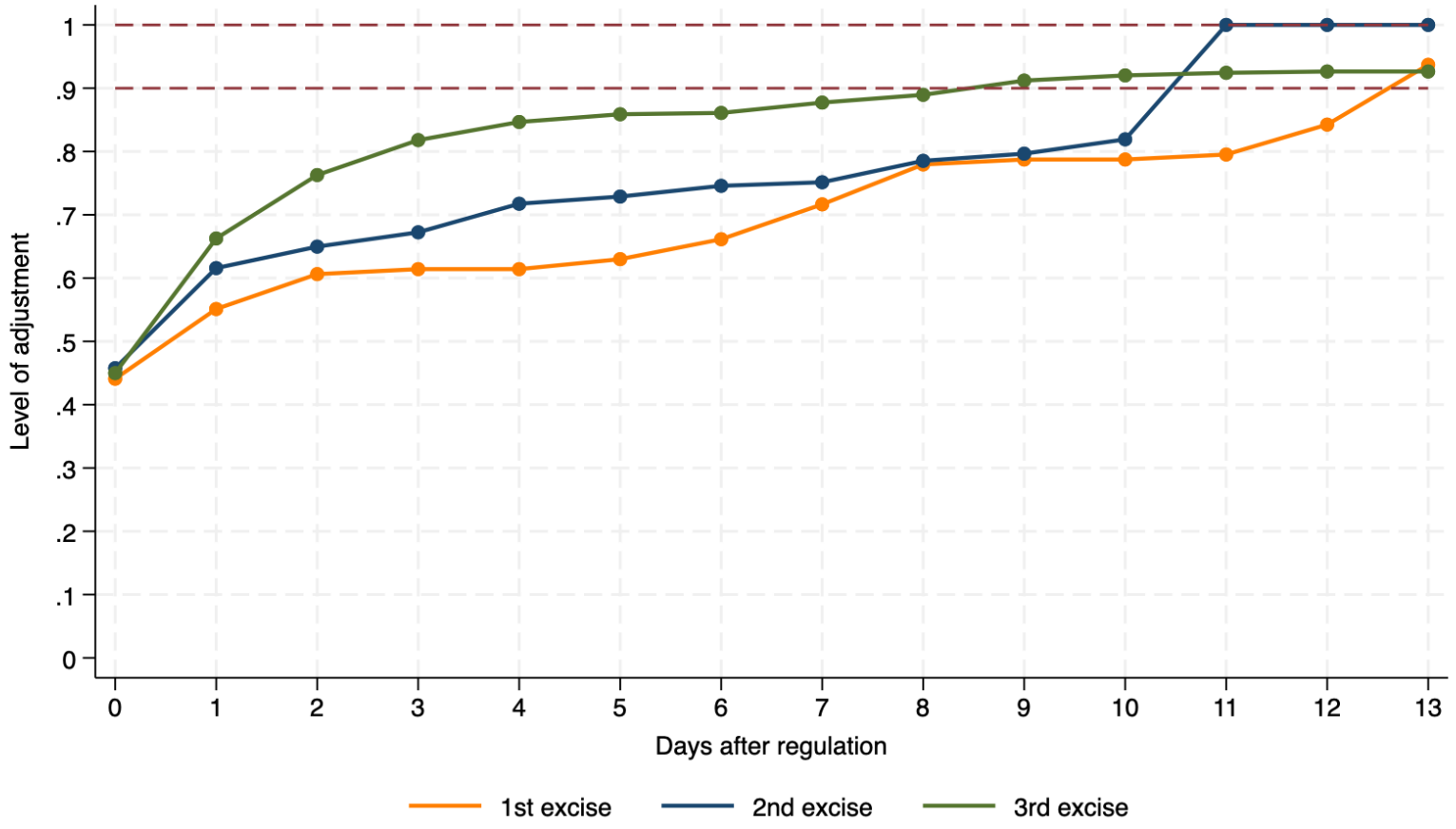
$$P_{jst} = \rho Tax_{jt} + \lambda_t + \lambda_{js} + \varepsilon_{jst}$$

for product *j* (diesel, Un95, Un100, super), station *s*, day *t.*

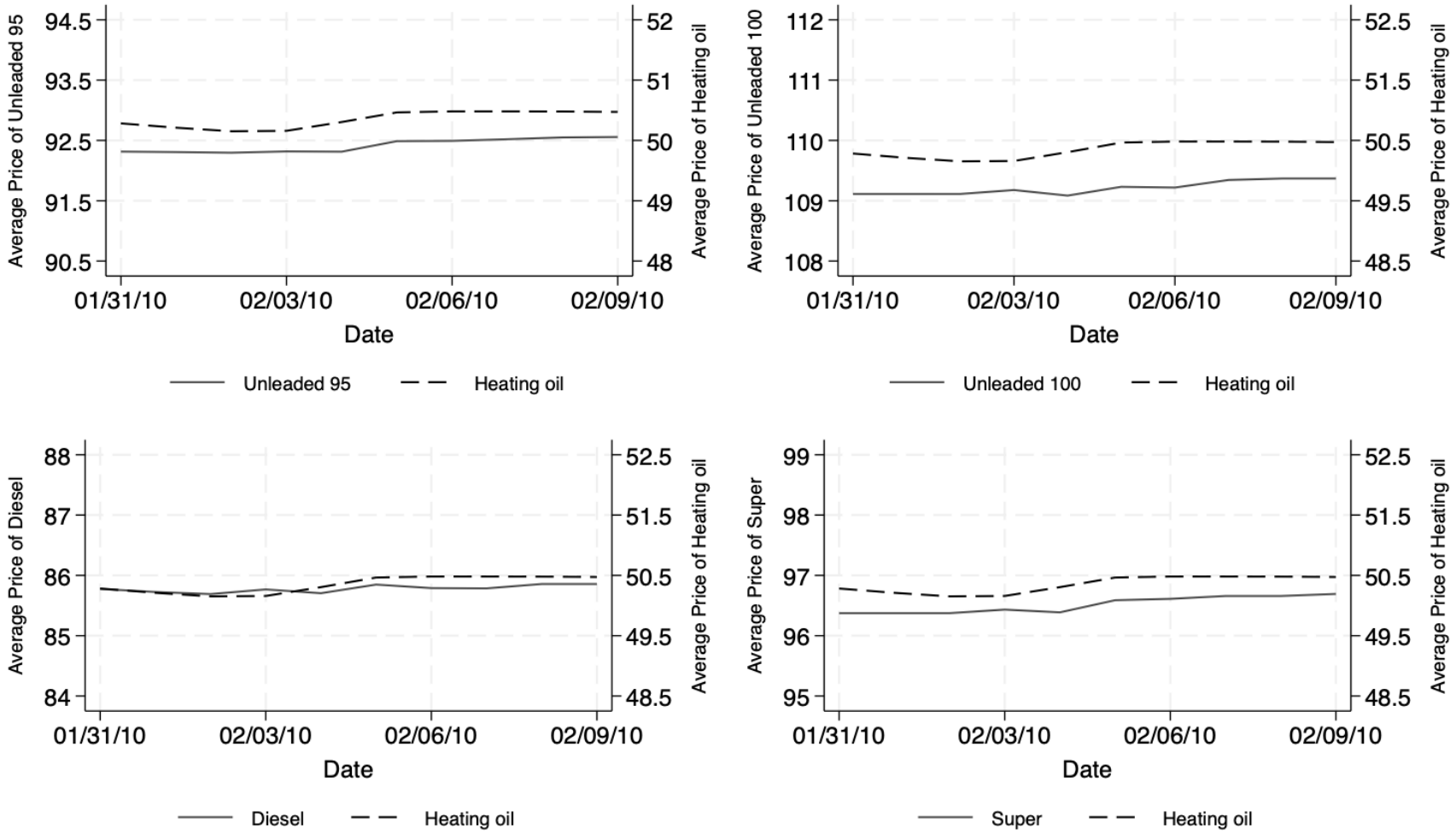
- Time window: 13-day $\{\tau - 1, \tau + 13\}$
- Controls: product-station FE, day FE
- Standard errors clustered at the gas-station level

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

Cumulative adjustment percentage



Parallel Trends BEFORE any changes



Parallel Trends BEFORE any changes

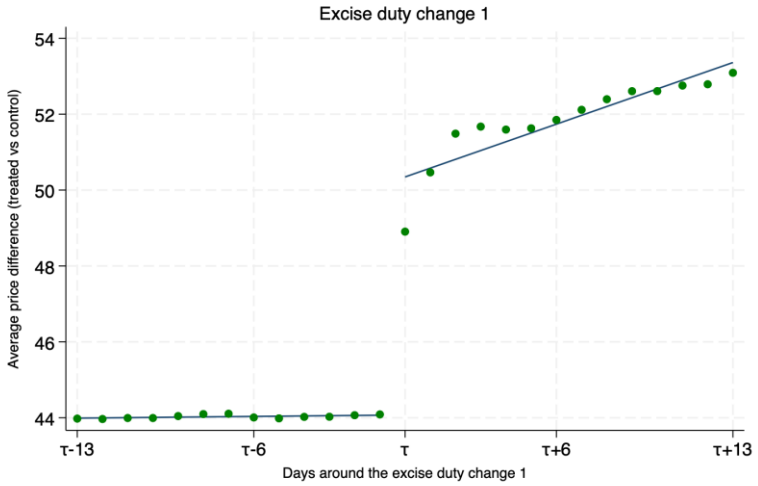
TABLE A1 - PARALLEL TREND TESTS

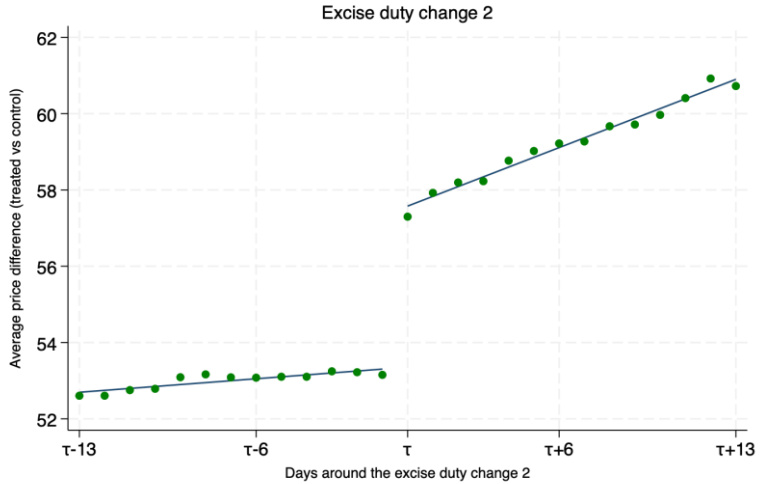
	(1) $Price_{jgt}$ 1st Excise	(2) $Price_{jgt}$ 2nd Excise	(3) $Price_{jgt}$ 3rd Excise
$Trend_t$	0.049***	0.091***	0.036*
	(0.011)	(0.021)	(0.019)
$Trend_t \times Treat$	-0.008	0.039	0.035*
	(0.012)	(0.027)	(0.019)
Window before the event	[τ-10, τ-1]	[τ-10, τ-1]	[τ-10, τ-1]
Adjusted R^2	0.953	0.963	0.969
Observations	3,662	4,777	14,595
Product type FE	yes	yes	yes
Station FE	yes	yes	yes

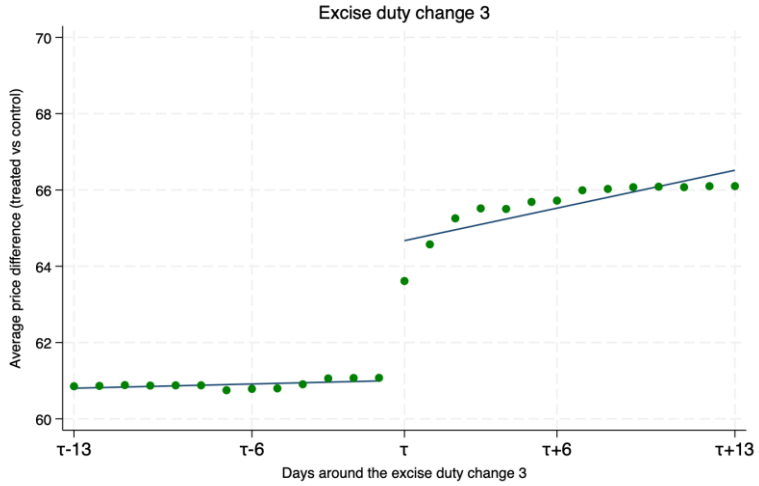
TABLE A3 - PARALLEL TREND TESTS (NON-PARAMETRIC)

VARIABLES Excise change	(1) $Price_{jgt}$ 1st Excise	(2) $Price_{jgt}$ 2nd Excise	(3) $Price_{jgt}$ 3rd Excise
Day(τ-10) × Treat	-0.656	-6.755**	-1.674
	(0.804)	(3.387)	(1.294)
Day(τ-9) × Treat	-0.138	-1.696	-1.632
	(0.888)	(2.081)	(1.258)
Day(τ-8) × Treat	0.286	-0.876	-1.615
	(0.691)	(2.041)	(1.258)
Day(τ-7) × Treat	0.644	-1.717	-2.180**
	(0.756)	(1.613)	(1.054)
Day(τ-6) × Treat	-0.389	-1.794	-2.538**
	(0.656)	(1.535)	(0.985)
Day(τ-5) × Treat	-0.513	-1.660	-3.141***
	(0.607)	(1.402)	(0.632)
Day(τ-4) × Treat	-0.782*	-1.660	-1.401***
	(0.402)	(1.402)	(0.345)
Day(τ-3) × Treat	-0.518	1.494*	-0.239***
	(0.327)	(0.788)	(0.071)
Day(τ-2) × Treat	-0.147	1.603**	-0.096
	(0.191)	(0.697)	(0.058)
Joint F-test (p-value)	0.303	1.259	5.746
	0.583	0.264	0.0169
Window before the event	[τ-10, τ-1]	[τ-10, τ-1]	[τ-10, τ-1]
Observations	4,560	5,932	18,081
Within R^2	0.953	0.960	0.970
Day FE	yes	yes	yes
Product type FE	yes	yes	yes
Station FE	yes	yes	yes

DiD in pictures







High pass-through in Athens inline with urban literature

TABLE 4: EXCISE DUTY PASS-THROUGH

	(1)	(2)	(3)	(4)
Estimation method	FE	FE	FE	FE
Dependent variable	$Price_{jgt}$	$Price_{jgt}$	$Price_{jgt}$	$Price_{jgt}$
Sample	1st excise	2nd excise	3rd excise	All excise changes
Tax	0.848***	0.985***	0.821***	0.872***
	(0.030)	(0.039)	(0.025)	(0.017)
Observations	1,024	1,309	3,992	6,325
Within R^2	0.893	0.816	0.728	0.994
Station × Product Type FE	yes	yes	yes	yes
Day FE	yes	yes	yes	yes
Excise*Station FE				yes
Excise*Type FE				yes

Methodology

- Difference-in-Differences framework:

$$P_{jst} = \rho(n_m)Tax_{jt} + \lambda_t + \lambda_{js} + \varepsilon_{jst}$$

for product *j*, on market *m*, in gas station *s*, on day *t.*

- Interaction of Tax with n_m: $\rho(n_m) = \rho_0 + \rho_1 n_m + \rho_2 n_m^2$

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

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

no effect of local competition on pass-through (radius)

TABLE 5: PASSTHROUGH AND COMPETITION BASED ON RADIUS

	(1)	(2)	(3)	(4)	(5)
Estimation method	FE	FE	FE	FE	FE
Dependent variable	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$
Radius	100m	300m	500m	1000m	1500m
			PANEL A		
Tax_{jt}	0.881***	0.894***	0.885***	0.932***	1.168***
	(0.018)	(0.018)	(0.020)	(0.047)	(0.164)
Tax_{jt} × Number of competitors	-0.049*	-0.023**	-0.006	-0.011	-0.051*
	(0.028)	(0.010)	(0.006)	(0.008)	(0.027)
			PANEL B		
Tax_{jt}	0.882***	0.895***	0.895***	0.897***	1.104***
	(0.018)	(0.018)	(0.022)	(0.071)	(0.162)
Tax_{jt} × Number of competitors	-0.077	-0.026	-0.019	0.013	-0.016
	(0.077)	(0.027)	(0.020)	(0.038)	(0.063)
Tax_{jt} × Number of competitors^2	0.023	0.001	0.003	-0.003	-0.004
	(0.055)	(0.008)	(0.004)	(0.005)	(0.008)
Observations	6,325	6,325	6,325	6,325	6,325
Within R^2	0.994	0.994	0.994	0.994	0.994
Station × Type FE	yes	yes	yes	yes	yes
Day FE	yes	yes	yes	yes	yes
Excise × Station FE	yes	yes	yes	yes	yes
Excise × Type FE	yes	yes	yes	yes	yes

no effect of local competition on pass-through (distance)

TABLE 6: PASSTHROUGH AND COMPETITION BASED ON DRIVING DISTANCE

	(1)	(2)	(3)	(4)	(5)
Estimation method	FE	FE	FE	FE	FE
Dependent variable	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$
Driving distance	0.1km	0.3km	0.5km	1.0km	1.5km
			PANEL A		
Tax_{jt}	0.876***	0.884***	0.888***	0.890***	0.890***
	(0.017)	(0.016)	(0.017)	(0.023)	(0.026)
Tax_{jt} × Number of competitors	-0.079	-0.040*	-0.022	-0.006	-0.003
	(0.049)	(0.021)	(0.014)	(0.006)	(0.003)
			PANEL B		
Tax_{jt}	0.876***	0.884***	0.885***	0.881***	0.920***
	(0.017)	(0.016)	(0.018)	(0.029)	(0.046)
Tax_{jt} × Number of competitors	-0.079	-0.046	-0.003	0.001	-0.013
	(0.049)	(0.054)	(0.033)	(0.013)	(0.012)
Tax_{jt} × Number of competitors^2		0.004	-0.008	-0.001	0.001
		(0.029)	(0.013)	(0.002)	(0.001)
Observations	6,325	6,325	6,325	6,325	6,325
Within R^2	0.994	0.994	0.994	0.994	0.994
Station × Type FE	yes	yes	yes	yes	yes
Day FE	yes	yes	yes	yes	yes
Excise × Station FE	yes	yes	yes	yes	yes
Excise × Type FE	yes	yes	yes	yes	yes

no effect of local competition on pass-through (time)

TABLE 7: PASSTHROUGH AND COMPETITION BASED ON TRAVELING TIME

	(1)	(2)	(3)	(4)	(5)
Estimation method	FE	FE	FE	FE	FE
Dependent variable	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$	$Price_{jst}$
Driving time	1min	2min	3min	4min	5min
			PANEL A		
Tax_{jt}	0.879***	0.876***	0.874***	0.889***	0.914***
	(0.018)	(0.019)	(0.023)	(0.029)	(0.033)
Tax_{jt} × Number of competitors	-0.020	-0.003	-0.001	-0.003	-0.005
	(0.016)	(0.008)	(0.006)	(0.004)	(0.003)
			PANEL B		
Tax_{jt}	0.882***	0.871***	0.854***	0.849***	0.874***
	(0.019)	(0.021)	(0.029)	(0.040)	(0.055)
Tax_{jt} × Number of competitors	-0.048	0.006	0.014	0.014	0.006
	(0.041)	(0.018)	(0.013)	(0.012)	(0.012)
Tax_{jt} × Number of competitors^2	0.014	-0.002	-0.002	-0.001	-0.001
	(0.018)	(0.004)	(0.002)	(0.001)	(0.001)
Observations	6,325	6,325	6,325	6,325	6,325
Within R^2	0.994	0.994	0.994	0.994	0.994
Station × Type FE	yes	yes	yes	yes	yes
Day FE	yes	yes	yes	yes	yes
Excise × Station FE	yes	yes	yes	yes	yes
Excise × Type FE	yes	yes	yes	yes	yes

Methodology

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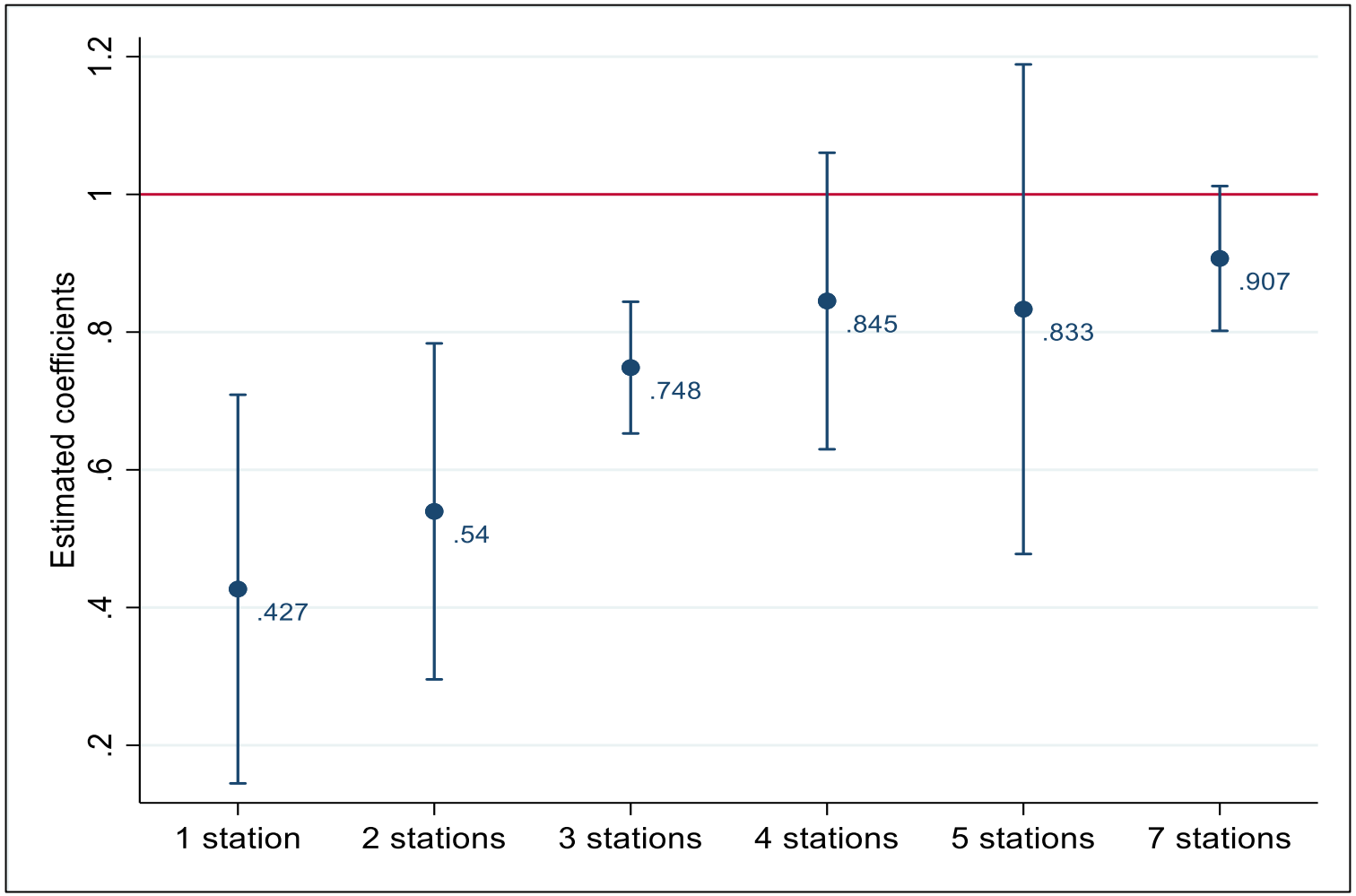
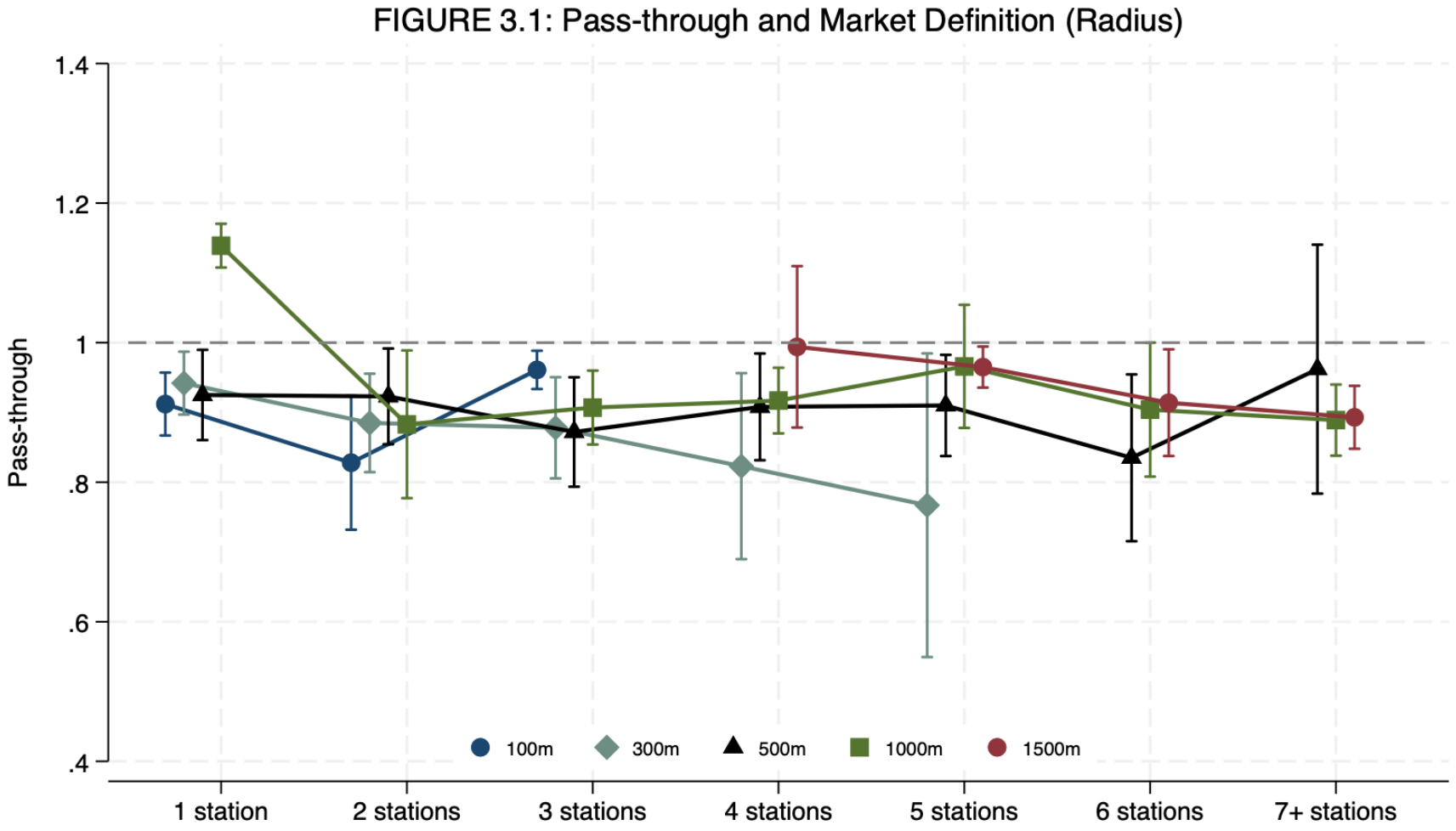
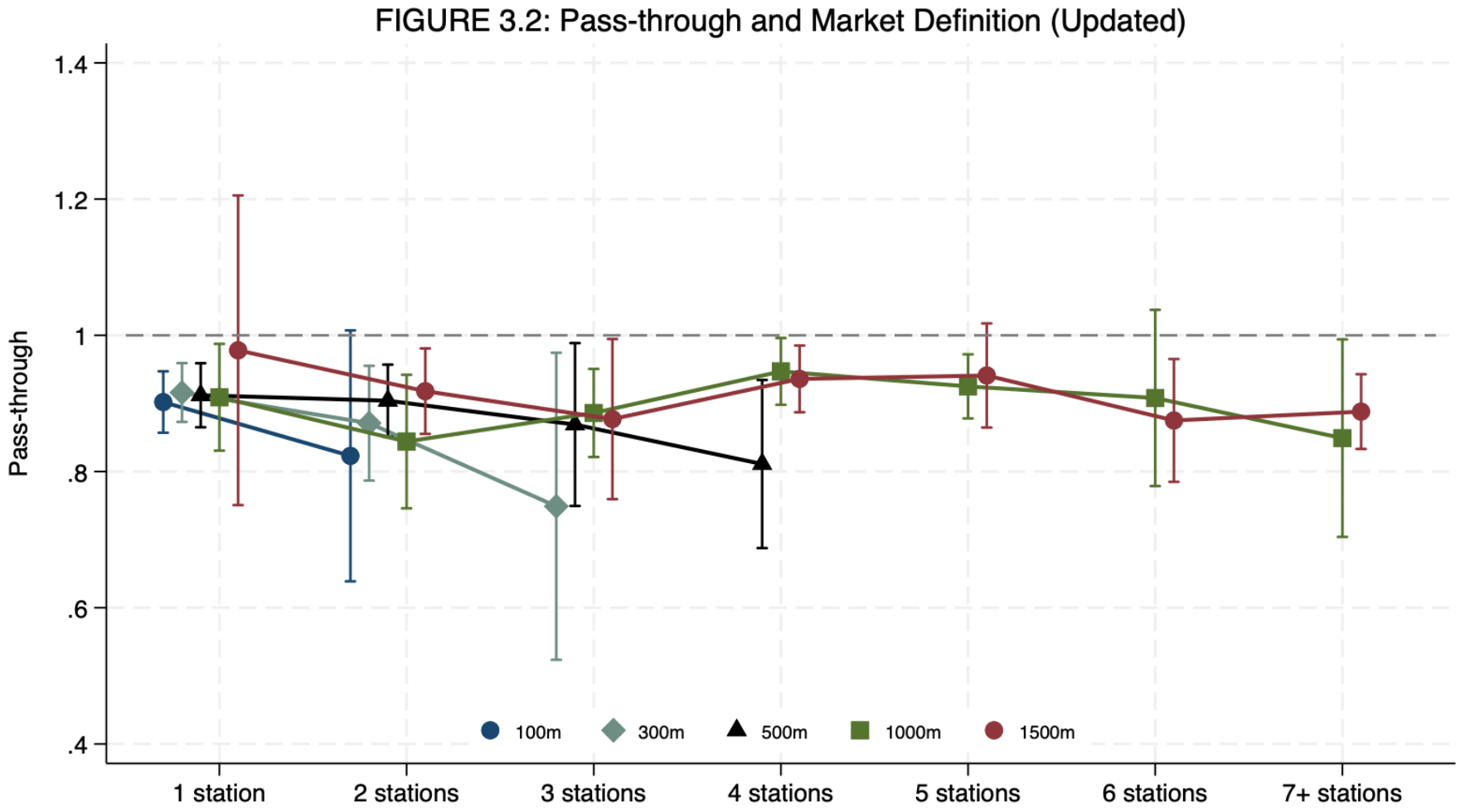


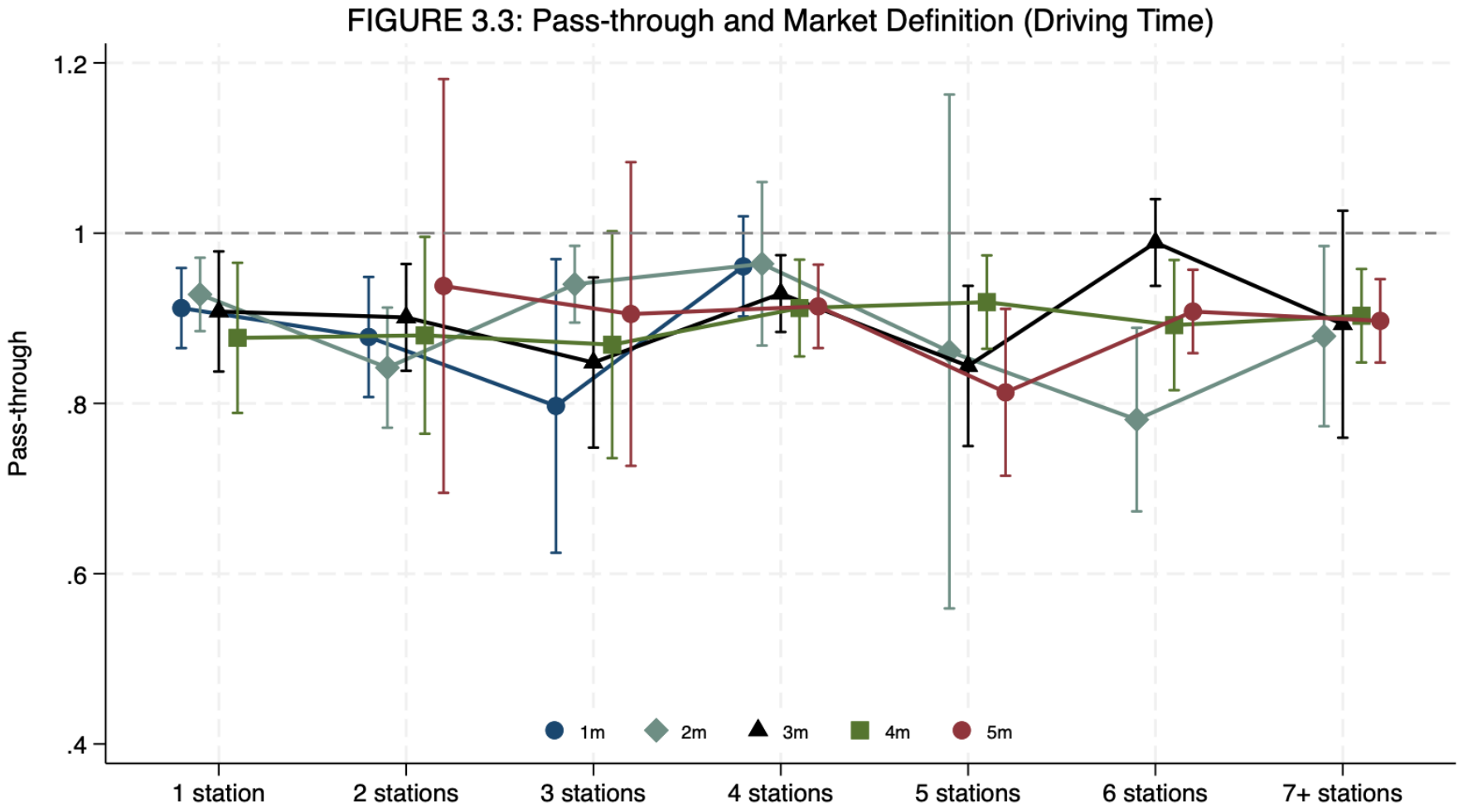
No impact of competition on pass-through (radius)



No impact of competition on pass-through (driving distance)

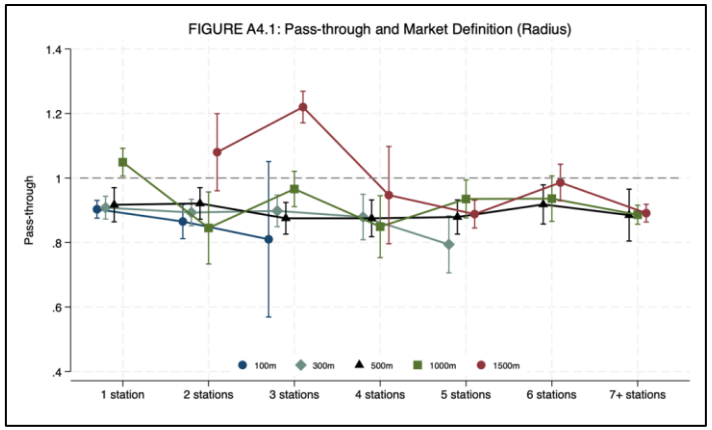


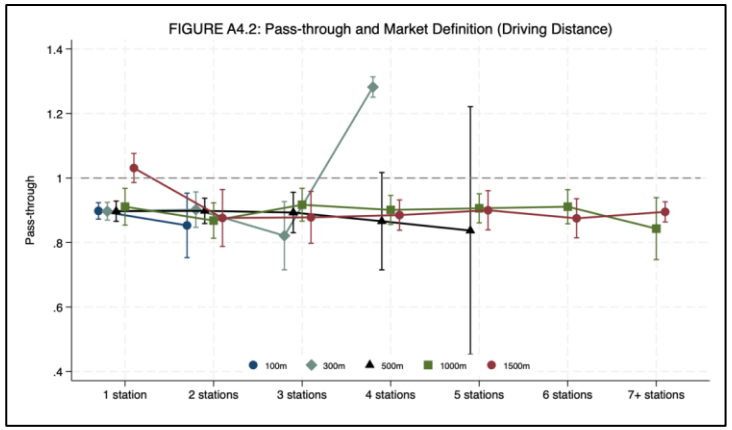
No impact of competition on pass-through (driving time)

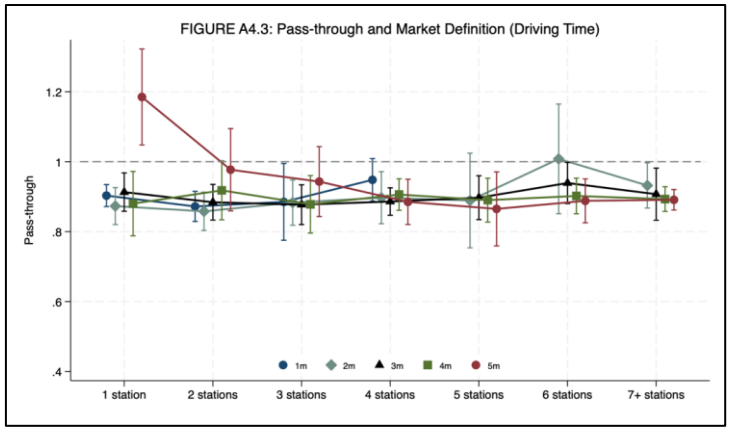


Robustness checks

UNLEADED95 & DIESEL ONLY







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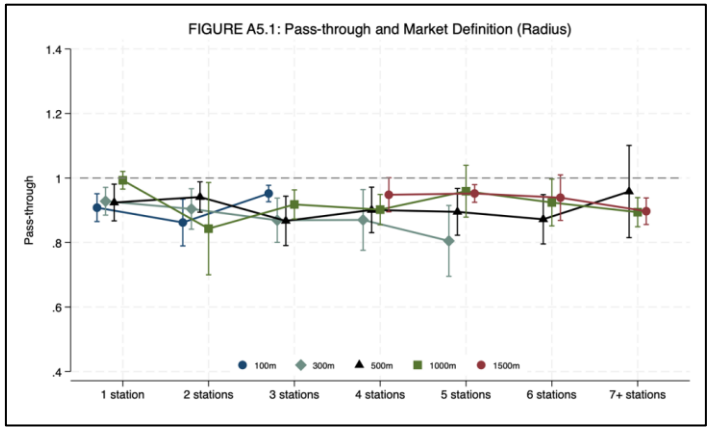

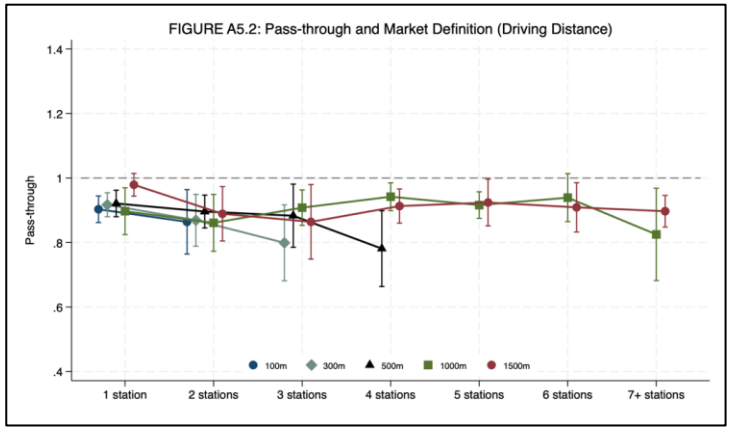

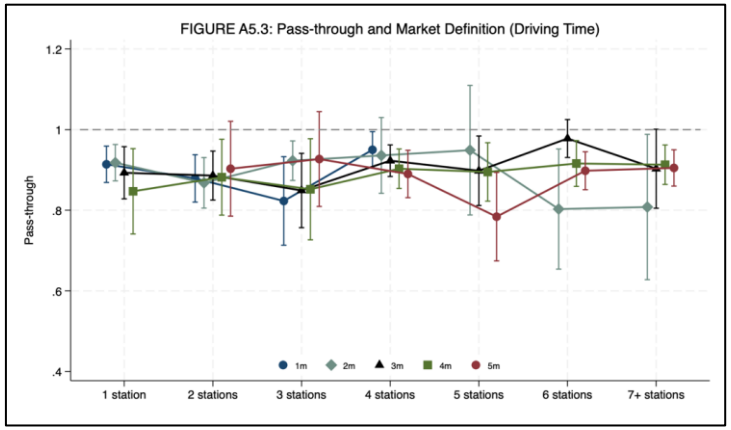

Conclusions

What we see:

Pass-through is almost indistinguishable from one even in monopoly settings regardless of the definition.

There is a flat relationship between pass-through and the number of nearby competitors.

Interpretation:

These results contradict theoretical predictions and the increasing pass-through pattern of the Greek islands.

They suggest an absence of market power and that gas stations in Athens face stiff competition.

Policy Implications:

Geographic market definitions based on arbitrary distance measures can be misleading.

Since such definitions are often used in antitrust analysis, caution is needed when identifying “local” markets.

WHAT IS THE “RIGHT” GEOGRAPHIC MARKET DEFINITION?

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