Uniform Retail Pricing and the Effect of Taxes

The Case of Sugar Taxes in Norway

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Motivation

- **Uniform pricing puzzle in retail markets:**
  - Why are firms not profit maximizing by price discriminating across geographical markets?
  - Current literature: Softens competition in highly competitive markets
- **This paper offers a new explanation:**
  - Heterogeneous consumers may self-select within a category.
  - Price discrimination may therefore instead occur *within* product categories.
- **Implications:**
  - Intra-category price discrimination reduces distributional concerns.
  - Uniform pricing matters for estimated welfare effects of taxes.

Preview of findings and contributions of the paper

) What does the paper do?

- **Theoretical model:**
  - If consumers perfectly self-select into product types, the elasticity of demand is independent of the distribution of consumers.
    $\Rightarrow$ Uniform pricing is optimal.
- **Empirical strategy:**
  - Using a change in sugar taxes introduced in Norway 2017/2018
  - Event study supplemented by DID
- **Preview of empirical findings:**
  - Positive effect of tax on prices, but limited demand response
  - Heterogeneity in pass-through between cheap and expensive items within taxed categories

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What are the contributions?

- **Novel data set allows for:**
  - Analyses based on actual (not self-reported) purchases
  - Richer analyses (e.g. pricing strategies, within category heterogeneity)
- **New explanation to uniform pricing puzzle**
- **Uniform pricing matters when estimating welfare effects of taxes**

Outline

Some related research

- **Pricing strategies of retail chains**
  - DellaVigna & Gentzow (2019) – *Uniform Pricing in US Retail Chains*
  - Adams & Williams (2019) – *Zone Pricing in Retail Oligopoly*

- **Sugar taxes (sin taxes) and pass-through**
  - *See for example:* Lockwood & Taubinsky (2017), Seiler et al. (2019) – *both on SWB taxes in Philadelphia*
  - *Other papers based on scanner data (US):* Silver et al. (2017), Rojas and Wang (2017), Bollinger and Sexton (2018)
  - *Papers on European countries:* Berardi et al. (2016) – *France*, Bergman and Hansen (2017) – *Denmark*

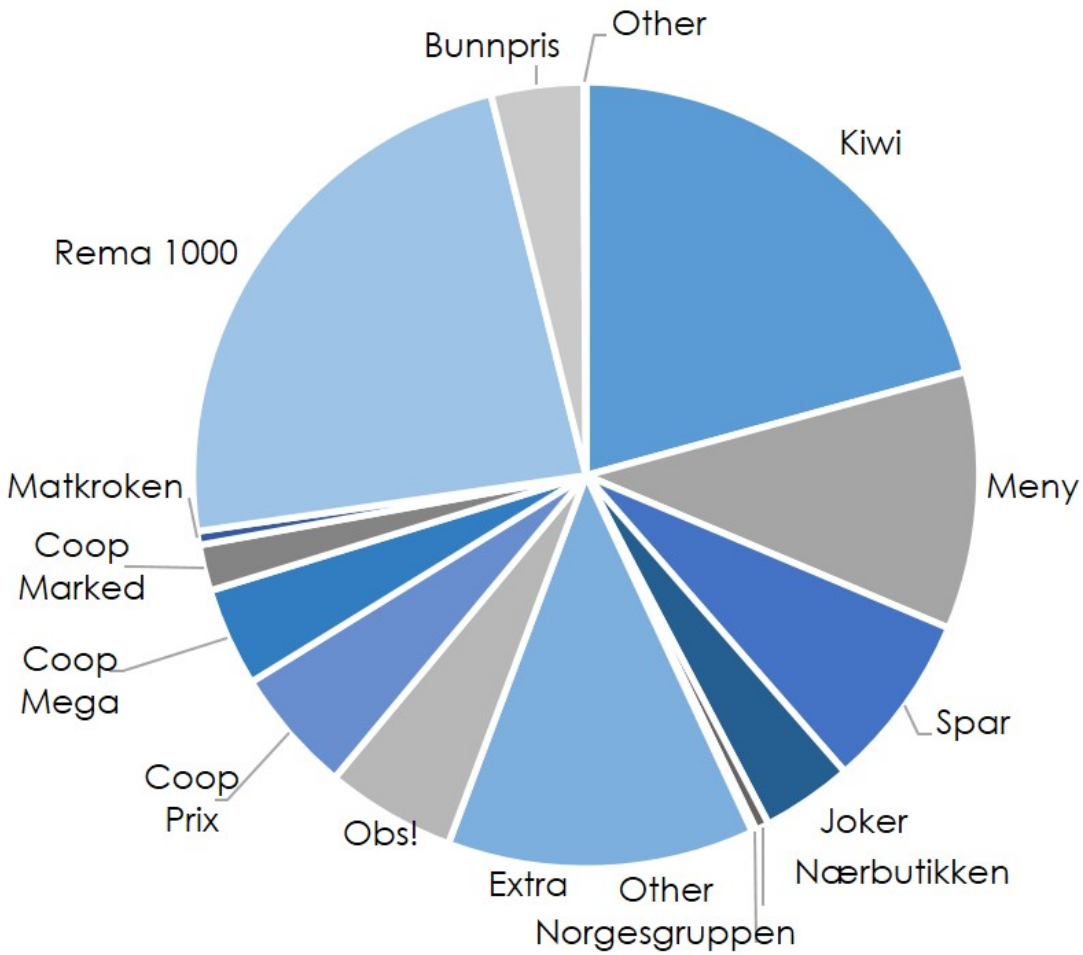
- **Self-sorting by quality preferences**:
  - *See for example:* Hallack (2006)

- **Consumer response to price changes**
  - *Cross-border shopping: Prices matter for demand:* Friberg et al. (*forthcoming*)
  - *Habit formation: Past choices matter for future consumption:* Atkin (2013) – *Intergenerational preferences*, Dynan (2000) – *Food consumption*

Outline

The Norwegian grocery industry

- Large number of store brands
- But only three integrated chains
- Data includes the following chains (covering 99.9% of the market):
  - Coop
  - NorgesGruppen
  - Bunnpris
  - Rema 1000



Total revenue in the Norwegian grocery industry (2017)
Source: Dagligvarerapporten 2018 (Nielsen)

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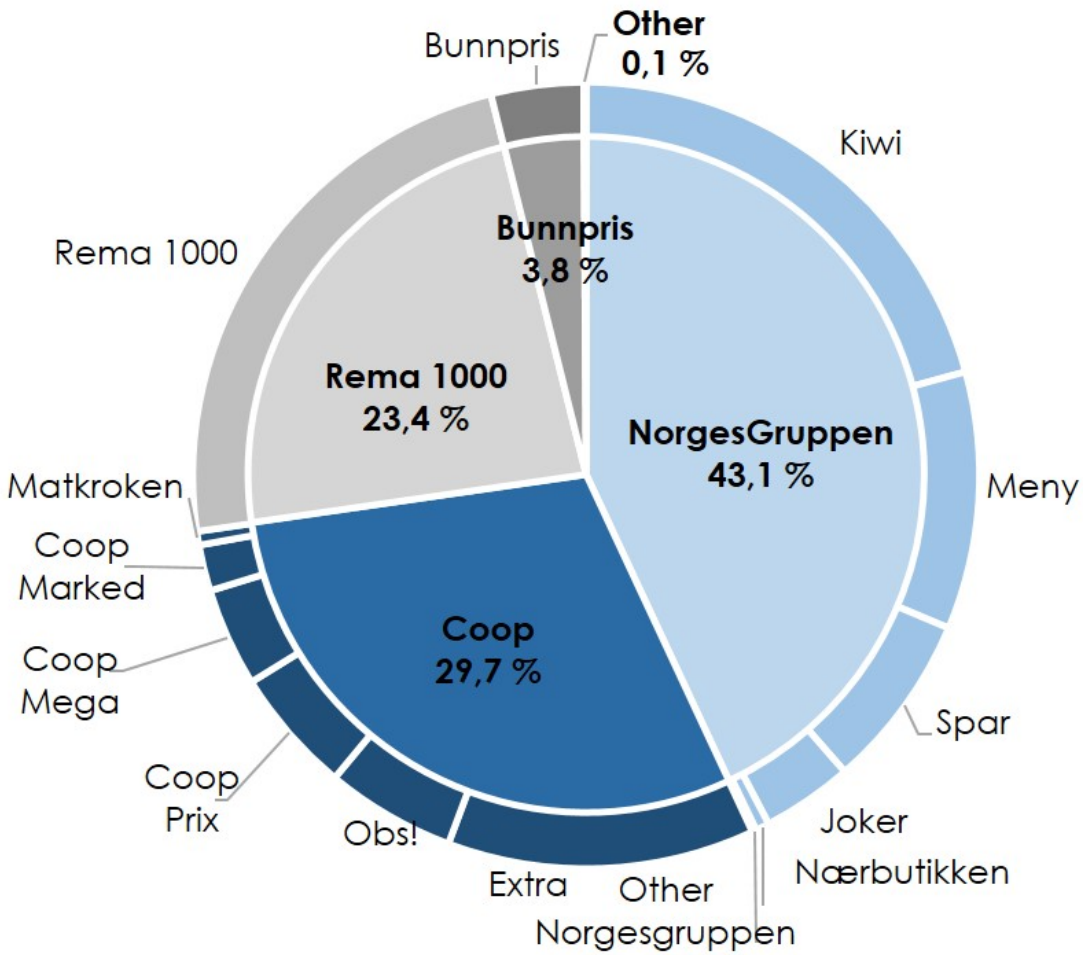


Total revenue in the Norwegian grocery industry (2017)
Source: Dagligvarerapporten 2018 (Nielsen)

Contents of the receipt data

- Contains *all individual receipts* from the four national chains (who cover 99.9% of the market)
  - Coop (Nov 2017 - Dec 2018)
  - NorgesGruppen (Sep 2017-Jan 2019)
  - Rema1000 (All stores: May2018-Dec 2018, 20 stores: Jun 2016-Jan 2021)
  - Bunnpris (Jun 2017 - Jan 2018)

- Includes, but not limited to, information on:
  - Prices (and discounts) for individual items
  - Quantities for individual items
  - Item ID numbers
  - Exact time of transaction
  - Store ID number (can be linked to exact coordinates)
  - Customer ID (loyalty program members for 20 Rema1000 stores)

- Large dataset:
  - Estimated size of raw data: $\approx$ 28 TB
  - Weekly store-price-item dataset for NorgesGruppen contains approximately 428 million observations.

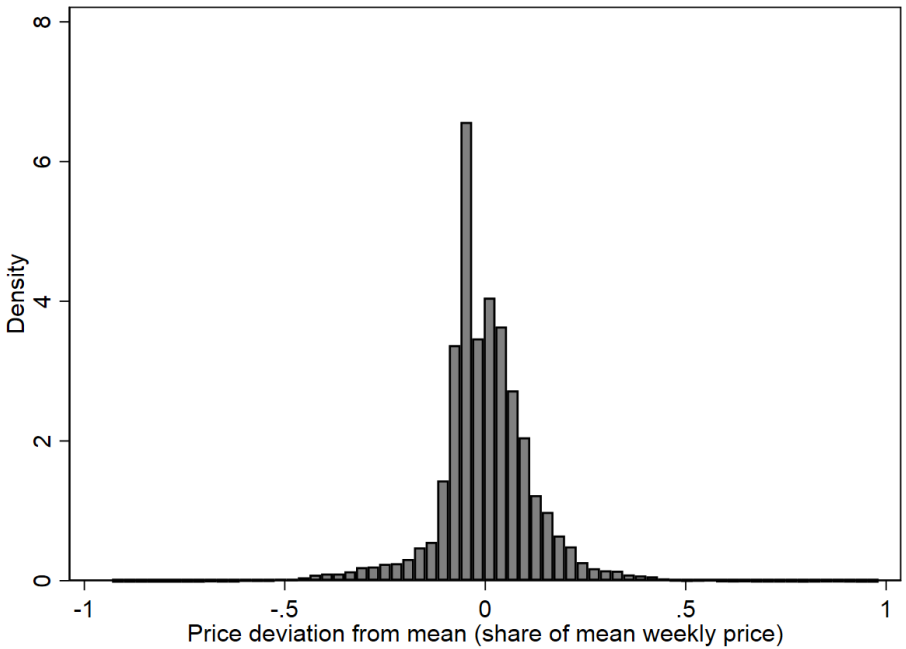
Other data sources

- Item information (webscraper, approx 66,000 products)
  - Weight (g)
  - Ingredients
  - Nutritional content (g/100g)
  - Product category (1006 categories)
- Tax category and tax level (NOK/kg) per item (manually coded/registered)
- Store information (webscraper, approx 3,000 stores)
  - Store location (address and GPS coordinates)
  - Store chain and store brand
- Demographics (at store location for Basic Statistical Units – "Grunnkrets")
  - Population size and density
  - Number of households
  - Share of young people
  - Share of female population
  - Avg. income among working
  - Avg. percentage of FTE

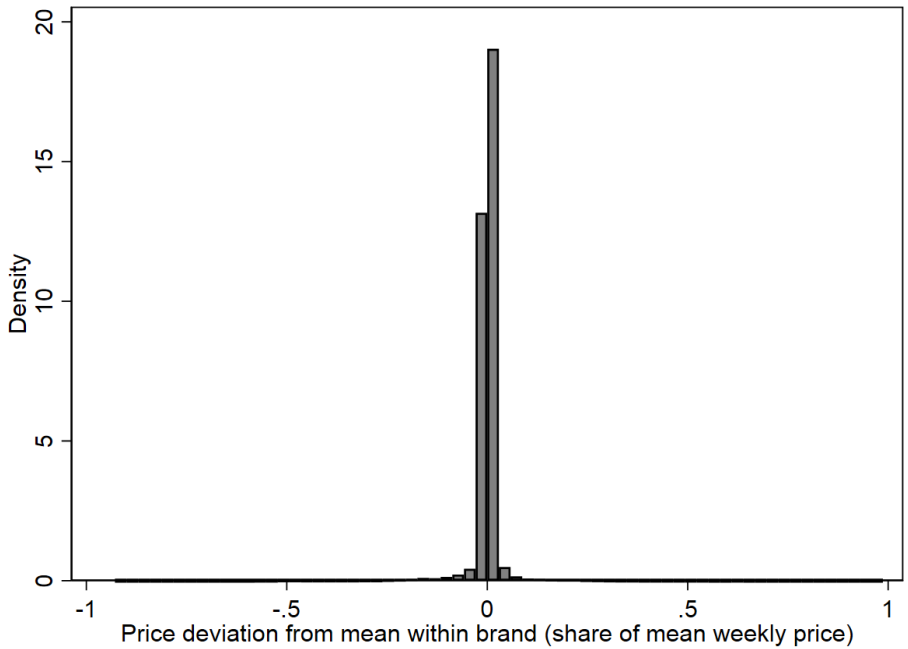
The firms' pricing strategies

Suggestive evidence of national within-brand pricing

Price variation across brands

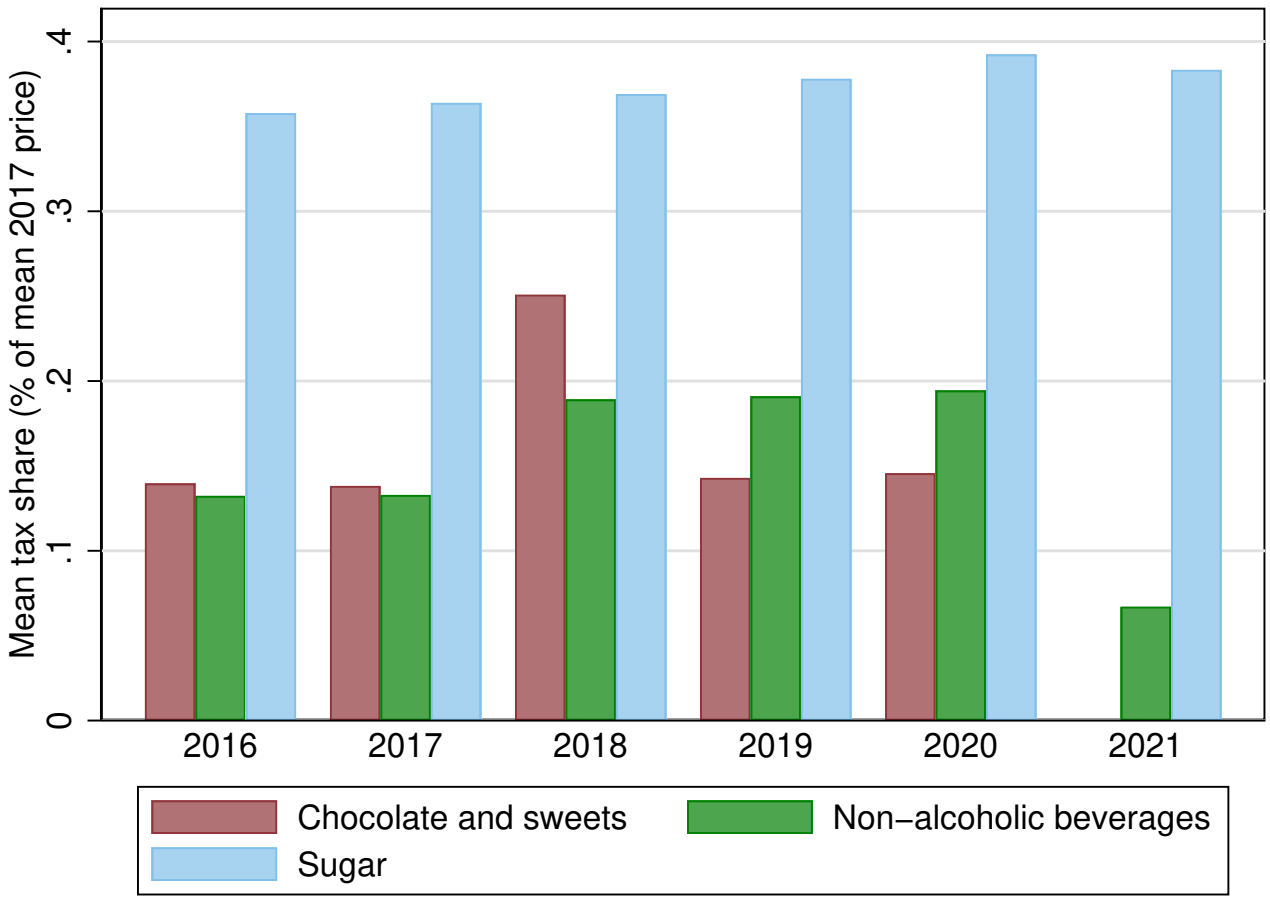


Price variation within brand



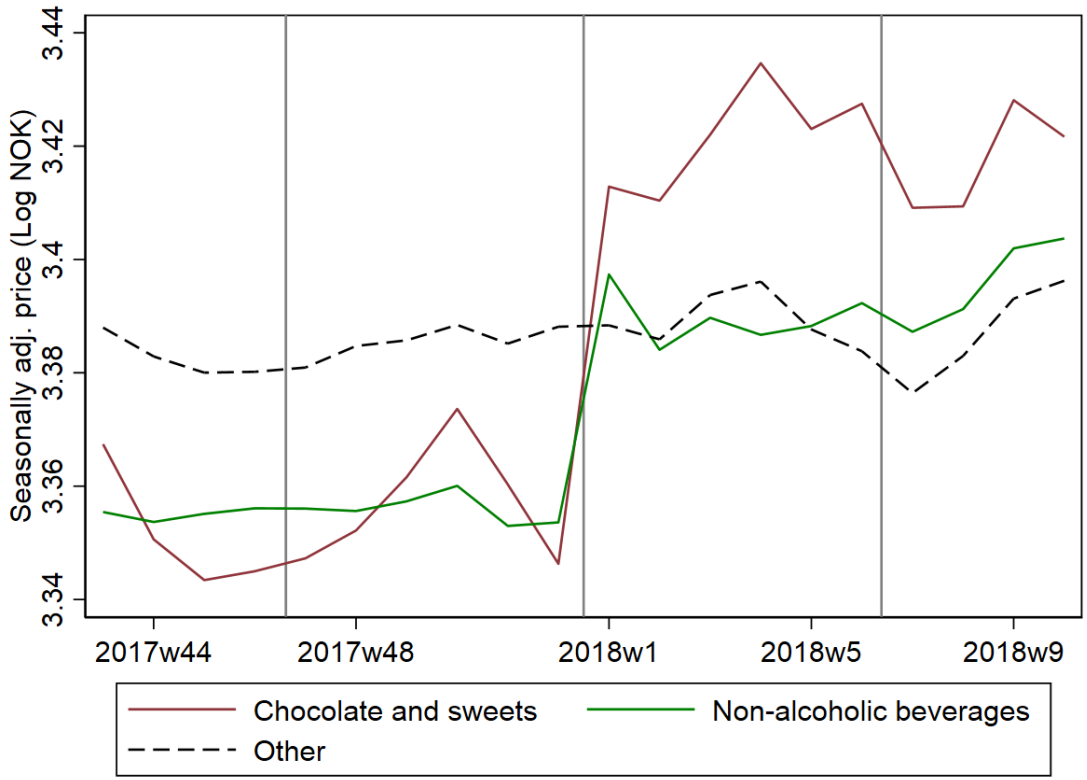
The tax on sweetened products

- Three separate taxes. Sugar, Chocolate and sweets, and sweetened beverages (non-alcoholic, 4 categories/tax levels)
- Main purpose of taxes: budgetary (Health concerns secondary purpose)
- Applied to product categories (not on sugar content)
- Excise tax (NOK/kg) at retail level, not listed on customer receipts



Evolution of prices – event study window

Weekly store-item prices



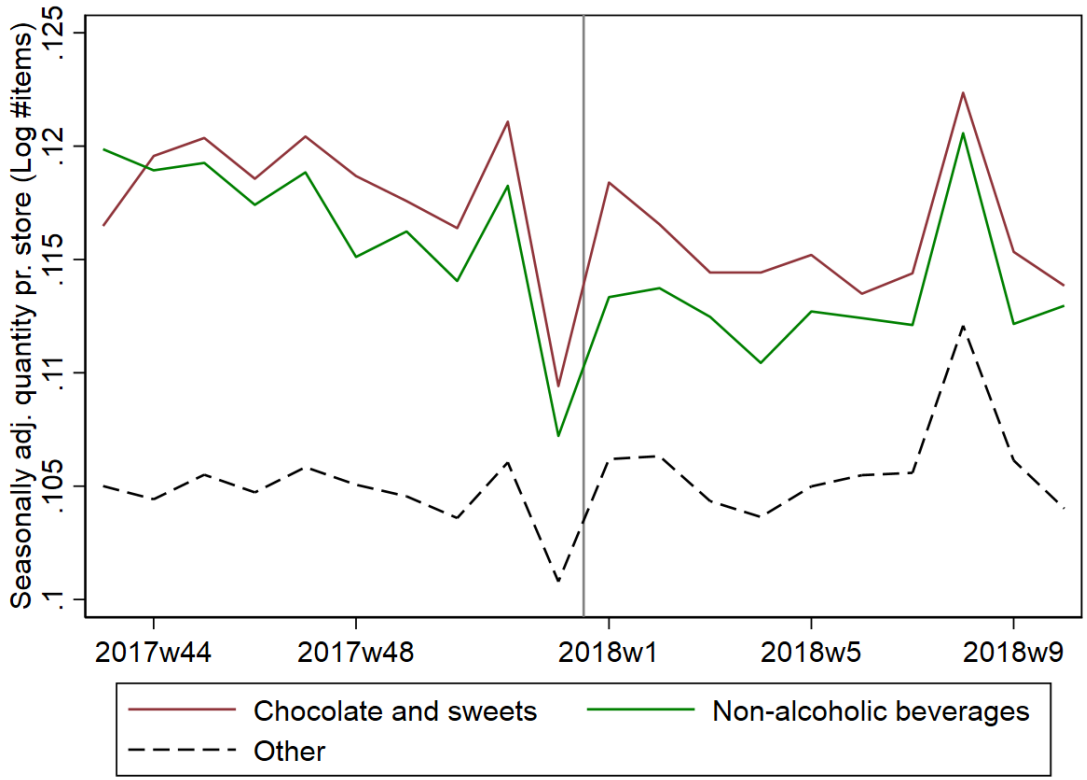
- Adjusting prices by removing calendar week (w) effect per item (i):

$$lnp_{ist} = \alpha_{iw} + \gamma_s + \varepsilon_{ist}$$

$$\tilde{lnp}_{ist} = lnp_{ist} \quad \hat{\alpha}_{iw}$$

Evolution of consumption

Weekly store-item quantities per store



- Adjusting quantities by removing calendar week (w) effect per item (i):

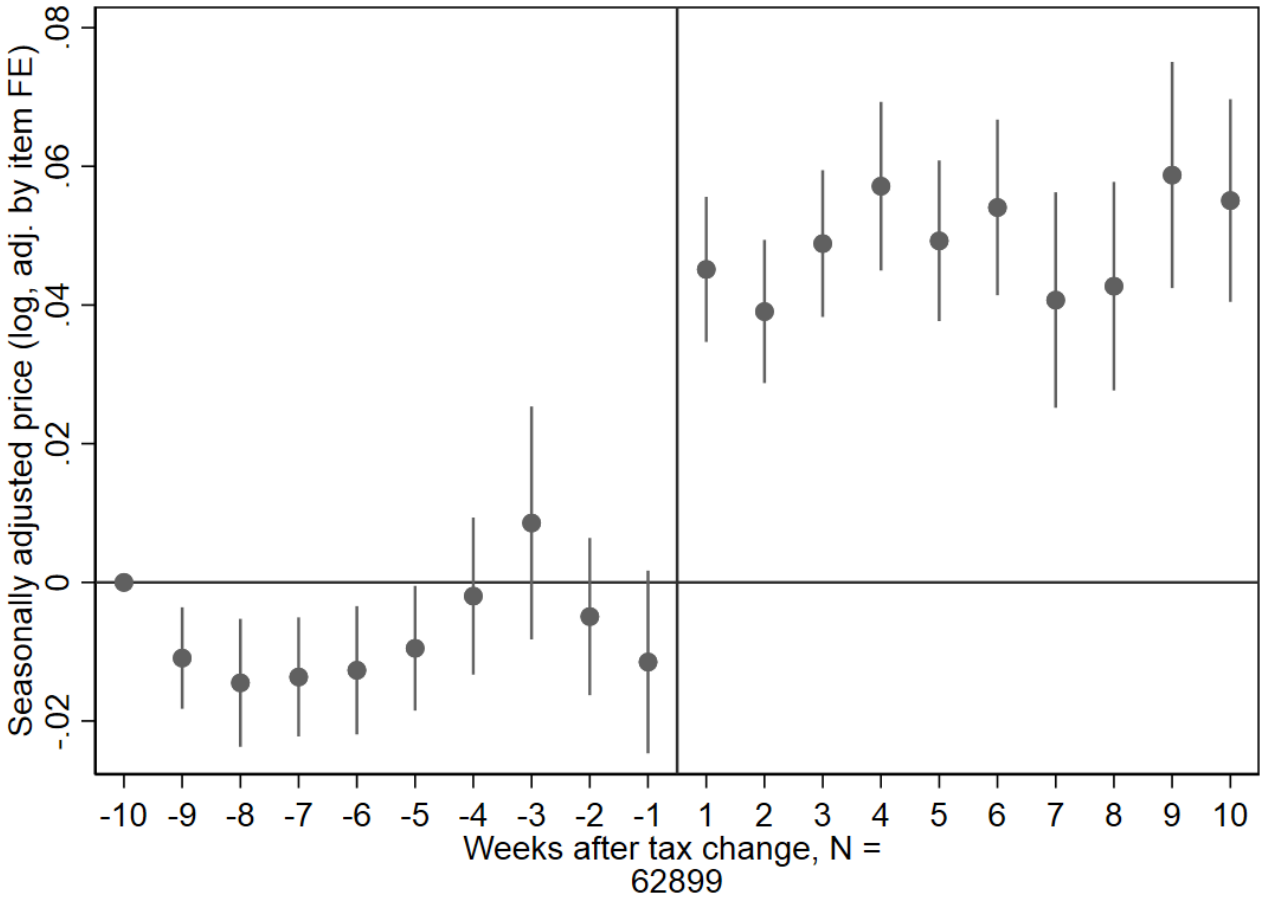
$$lnq_{ibt} = \alpha_{iw} + \gamma_s + \varepsilon_{ist}$$

$$\tilde{lnq}_{ist} = lnq_{ist} \quad \hat{\alpha}_{iw}$$

Outline

Event study – Effect of 2018 tax change on seasonally adjusted prices

Tax increase affects prices

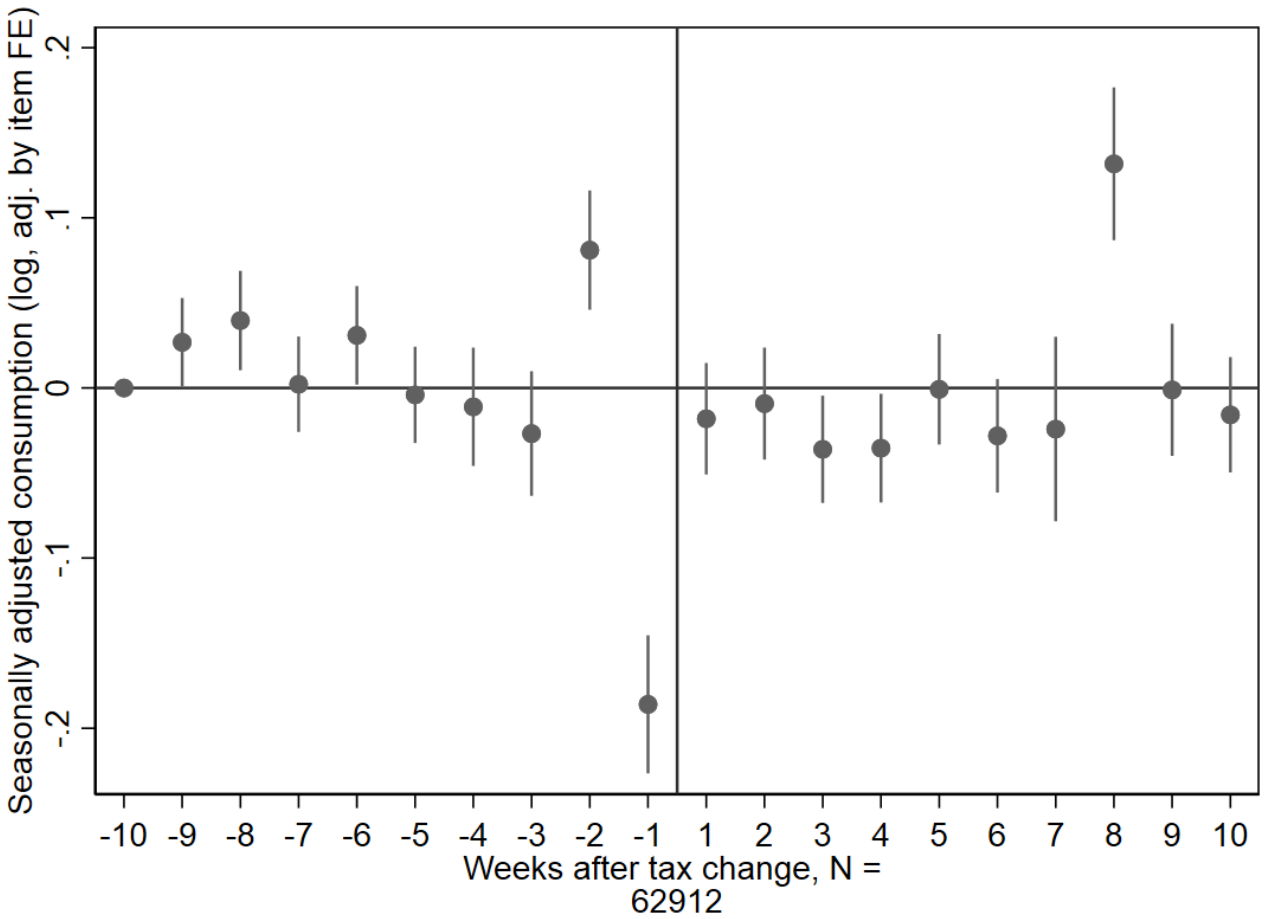


$$ln(p_{ibw}) = \alpha_i + \beta_s + \sum_{t=-10}^{10} \gamma_t D_{week} + \varepsilon_{ist}$$

*Standard errors clustered at item level.

Event study – Effect of 2018 tax change on seasonally adjusted quantities

No evidence of demand response



$$ln(q_{ibw}) = \alpha_i + \beta_s + \sum_{t=-10}^{10} \gamma_t D_{week} + \varepsilon_{ist}$$

*Standard errors clustered at item level.

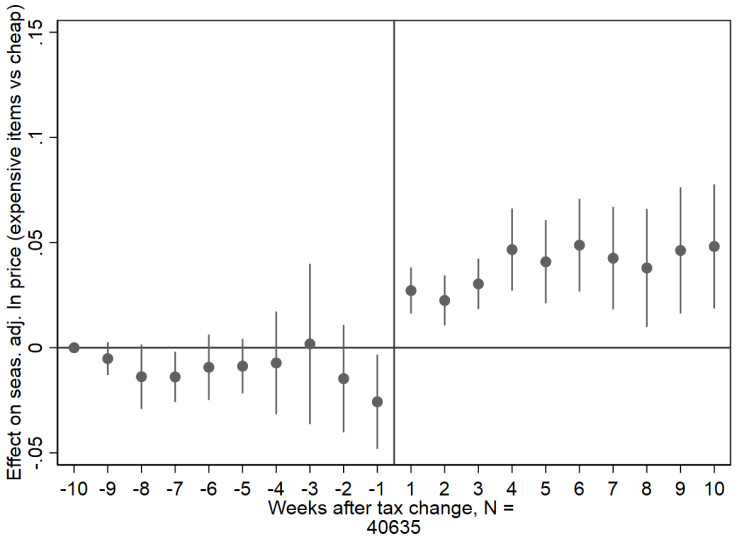
Heterogeneous effects across items?

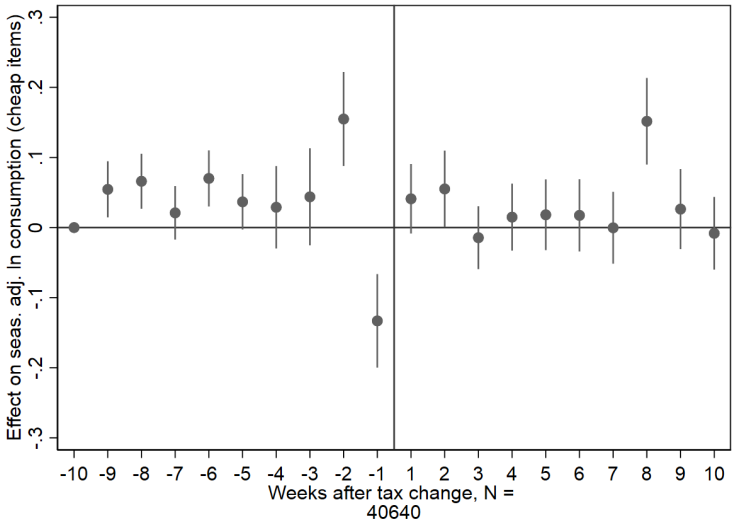
Comparing high- and low-price sweets

Prices

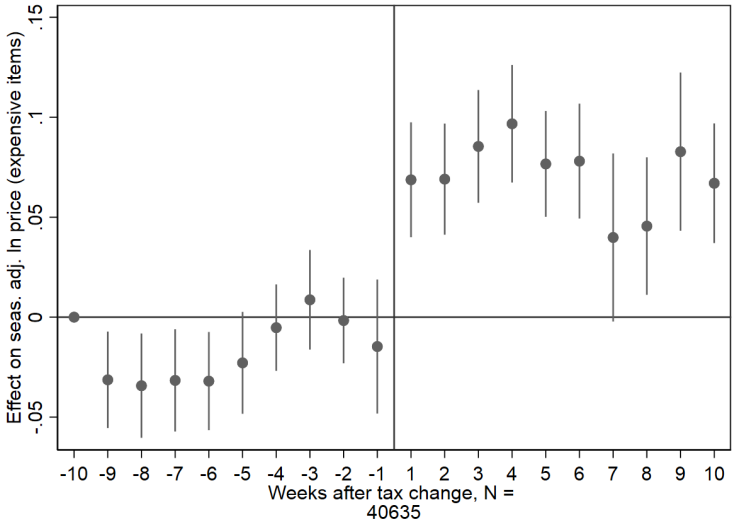
Quantity

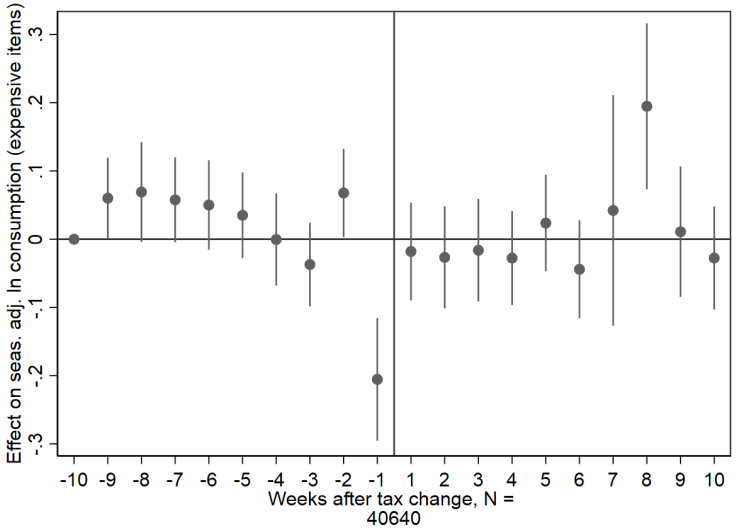
Cheap





Expensive





Pass-through and demand elasticities

Identification strategy

Pass-through:

$$p_{ist} = \beta_0 Tax_{it} + (Tax_{it} \quad X_{is})'\beta_1 + \theta_i + \gamma_s + \varepsilon_{ist} \tag{1}$$

Demand elasticity (IV):

$$lny_{ist} = \beta_0 ln\hat{p}_{ist} + (\hat{p}_{it} \quad X_{is})'\beta_1 + \theta_i + \gamma_s + \varepsilon_{ist} \tag{2}$$

- p_{ist} denotes the *seasonally adjusted* price of item i, store s and time t.
- y_{ist} denotes *seasonally adjusted* quantity for item i, store s and time t.
- Tax_{it} denotes the tax on item i at time t.
- θ_i and γ_s are item and store fixed effects, respectively.
- X_{is} is a vector of item/store characteristics (e.g. price level of the item, income of households in area).

Heterogeneous effects across items?

	(1) Seas. adj. price (NOK)	(2) Seas. adj. price (NOK)	(3) Seas. adj. price (log, adj. by item FE)	(4) Seas. adj. quantity (log)	(5) Seas. adj. quantity (log)
Tax (NOK/item)	0.678***	0.698***	0.109***		
	(0.143)	(0.181)	(0.0104)		
Seasonally adjusted price (log, adj. by item FE)				-1.053	-1.278**
				(0.684)	(0.545)
Interactions					
D_tax_expensive=1		1.122**			0.0725*
		(0.488)			(0.0390)
Observations	65 557	42 141	65 557	65 559	42 142
Store FE	Yes	Yes	Yes	Yes	Yes
Item FE	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses (clustered at item level),
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Summary and work in progress

) Main contributions to existing literature:

- **New explanation to uniform pricing puzzle:**
  Multi-product firms and consumer self-selection into product types can be a part of the explanation.

- **Novel data set allows for:**
  - Analyses based on actual (not self-reported) purchases
  - Richer analyses (e.g. pricing strategies, within category heterogeneity)

- **Implications:**
  - Welfare effects of uniform pricing may be smaller
  - Consumer self-sorting matters for estimation of welfare effects of taxes (product category pass-through differs for consumer types)

Thank you!

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