Minimum Wages and Price Pass-Through

Timothy J. Richards   Ujjwol Paudel
Arizona State University

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Introduction

Bloomberg

US Edition

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Wealth
Economics

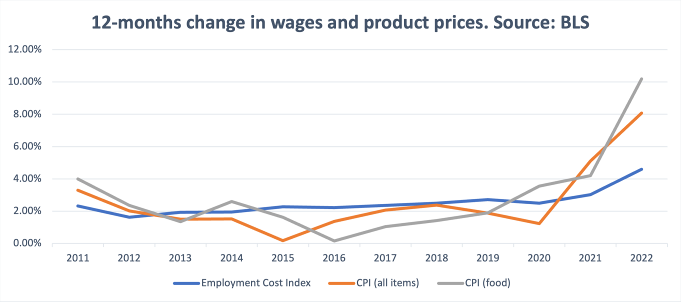
Employment Costs Surge Most Ever, Stoking U.S. Inflation Concern

- Index increased 1.4% in first quarter, 4.5% from year ago

The New York Times

Food Prices Soar, and So Do Companies' Profits

Some companies and restaurants have continued to raise prices on consumers even after their own inflation-related costs have been covered.



Introduction

- Several sources for 2021-23 food price inflation
  - Federal stimulus, rising input prices, rising retail concentration, East-Europe conflict
  - Greedflation, as the articles above suggest (?)
  - Rising minimum wages (?)
  - What is inflation, really? Levels vs changes
- Minimum wage hikes are important in food retailing
  - Labor forms $\sim$ 16% of operating costs (US Census, 2023)
  - $\sim$ 25% of grocery sector workers are within 1% of the minimum wage (US Census, 2023)
- Large number of MW changes from 2011-2021
  - No. of new MW implementations = 204, legislation = 141
  - Two treatments can have differential effects

Introduction

- Growing public concern that inflation is actually ‘greedflation’ due to market power.
- What is ’greedflation,’ really?
  - Evidence of firms’ profit rising while costs rise.
  - Strategic obfuscation is one possibility.
  - Prices rise because consumers expect them to rise, and retailers are happy to oblige.
- Estimated pass-through rates, *how input cost increases affect product prices*, differ
  - Do retailers use general inflation as an excuse to increase pass-through rates? *No inflation for 20 years.*
  - Prior studies do not consider the role of competition and consumer demand on MW price pass-through.
- We aim to address these concerns.

Preliminary Results

- What is the MW pass-through rate during ***low inflation*** environments?
  - Wage-price elasticity of 0.081. More than complete pass-through.
- What is the MW pass-through rate during ***high inflation*** environments?
  - Wage-price elasticity of 0.12. More than complete pass-through.
- How do consumer demand and retail competition affect the MW pass-through?
  - Strategic obfuscation by retailers and consumer expectations help explain the results.
  - Wage-price elasticity of 0.06. Roughly complete pass-through.
- **BUT**, structural estimates eliminate inflation effects!
  - Market power not an important explanation
  - Over-shifting still present but driven by curvature, or structure of demand.
  - Greedflation likely driven by structure of demand

Research Strategy

Data Sources

- **Sample period:** 2011 – 2021
- **Prices**: Nielsen Kilts Retail Scanner data
- **Demographics**: Nielsen Kilts Household Panel data
- **Socioeconomic**: US Census Bureau
- **Minimum wage series**: *Vaghul and Zipperer (2022)*

Estimation Approach

- Reduced-form evidence from TWFE specifications and *'heterogeneity-robust DiD'* methods
- Estimate a discrete choice model of market-level demand
  - Flexible curvature estimates so pass-through can vary with general inflation
- Estimate a Bertrand-Nash model of retail pricing
  - Captures market power effect on pass-through
- Counterfactual simulations to examine MW pass-through estimates

Roadmap of Talk

Background

Data and Descriptive Statistics

Empirical Strategy

Results

Conclusion

Background — Broader Relevance

- Minimum wages are *exogeneous* unlike other costs like commodity prices
  - important for identification *(Allegretto et al., '17)*
- MW hikes impact $\geq$ 25% workers in food retailing *(US Census, '23)*
- Food retailers have high control in setting prices, so pass-through can be substantial
  - *Ellickson and Grieco '13; Ellickson '16*
- Low-income families spend $\sim$ 25% of income on food-at-home *(USDA-ERS, '23)*
  - Possibly large welfare effects due to MW pass-through
- Role of greedflation or strategic obfuscation in high inflation regimes
  - *Ellison & Ellison, '09; Ellison & Wolitzky, '12; Richards et al., '20; Allender et al., '21*
- Retail food industry is ideal for studying MW price pass-through
  - Retailers face hyper-local competition in diverse markets *(Ellickson & Grieco, '13; Arcidiacono et al., '20)*

Background — Literature

- Prior studies report mixed results for MW pass-through on food prices
  - *Minimal (Ganapati & Weaver, '17); Incomplete (Renkin et al., '22); Over-shifting (Leung, '21)*
  - Some of these TWFE estimates are likely biased as MW hikes are time-variant and can have dynamic effects (*Goodman-Bacon, '21*)
  - And they don't consider the role of inflation, demand, and retail competition
- Theory suggests pass-through rates are ambigious during inflation
  - Depends on the intensity of consumer search (Tappata '09; Chandra & Tappata '11; Lewis '11)
- Demand curvature and competition interact in equilibrium
  - *Bulow & Pfleiderer, '83; Weyl & Fabinger, '13; Miller et al., '17; Miravete, Seim & Thurk, '18, '22*
- Deep literature on MW effects but none consider the role of inflation structurally
  - Employment *(Card & Krueger, '94; Cengiz et al., '19; Azar et al., '23)*, Crime *(Fone et al., '23)*, Income *(Dube, '19)*

Contributions

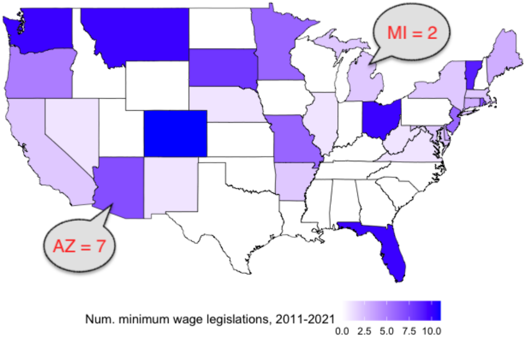
- Contributions to the labor economics and empirical IO literatures
- Provide structural estimates of MW pass-through in food retailing industry
  - *Leung ('21) and Renkin et al. ('22)*
- Test strategic obfuscation hypothesis in food retailing
  - *Allender et al. ('21); Birchall & Verboven ('22); Miravete et al. ('22)*
- Differentiate pass-through rate in low- and high-inflation regimes
  - *Provide empirical test and explanation of inflation on market conduct*
  - *Cecchetti ('86); Ellison & Ellison ('09); Allender et al. ('21)*
- Estimate effect of demand curvature on pass-through
  - *Curvature is theoretically important to cost pass-through estimates*
  - *Weyl & Fabinger ('13); Miravete, Seim & Thurk ('22)*

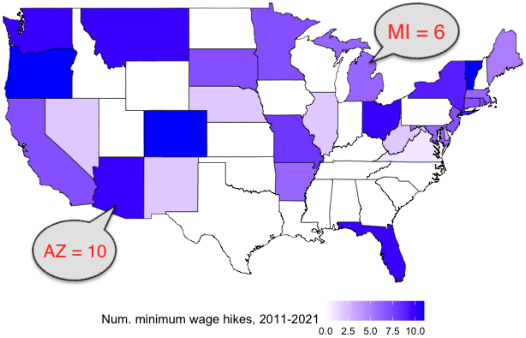
Roadmap of Talk

Data

- Nielsen retail scanner data covering $\sim$ 35,000 stores across all states
  - *Create banner-week level price, sales, and quantity indices*
  - *Create price index to approximate BLS CPI (Beraja et al., '19; Leung, '21)*
  - *Store attributes: #SKUs sold, % items on display, % items featured, #same-chain stores* ▸ Attributes
  - *Drop markets without minimum wage or consistent set of rivals*
- Demographic and socioeconomic data
  - **Kilts HMS:** *age, education, income, household size for each county in scanner data*
  - **Census Bureau:** *county population, house prices, and unemployment and inflation rates*
  - **BLS:** *market level PPI, electricity, marketing, transportation indices* ▸ IV
- MW series from Vaghul & Zipperer ('22)
  - *Govt. and media websites for legislation and implementation dates*
  - *Total legislations from 2011 to 2021 is 141; implementations = 204*

Data — MW Legislation and Implementations





- *Substantial variation of MW legislations and implementations across years (2011-2021) and markets*

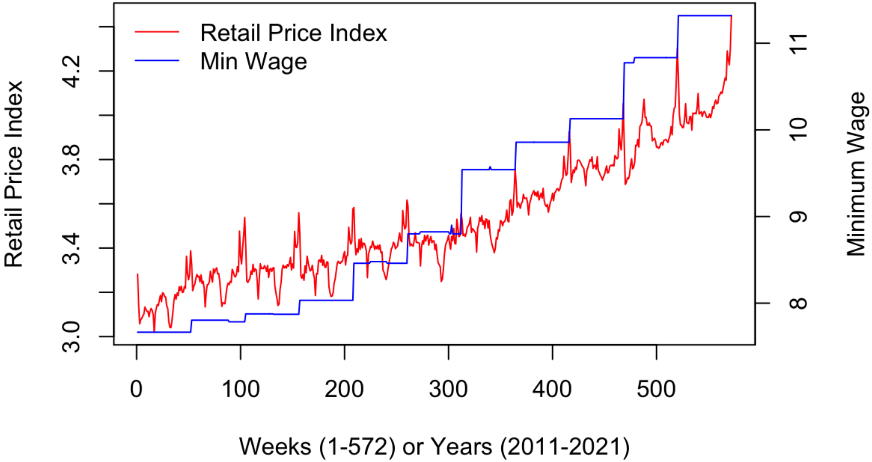
Data — Summary Statistics

Variables	Units	Mean	Std. Dev.	N
Store Volume	Units / Wk	5,627,097	6,717,335	17,343
Feature	%	6.4802	8.5233	17,343
Display	%	4.4530	10.3887	17,343
Variety	#	11,402	7,982	17,343
Store Price	$ / Unit	$3.5575	$1.0113	17,343
Education	Years	11.6379	0.4350	17,343
Income	$ 000 / Yr	$66.5033	$7.5478	17,343
Age	Years	50.8081	1.4483	17,343
Household Size	#	2.2116	0.1183	17,343
Minimum Wage	$ / Hr	$9.2339	$1.8642	17,343
MW Leg-Implem Lag	Weeks	52.3	35.5	17,343
Retail Wage	Index	382.5384	23.8377	17,343
Electricity	Index	145.8650	19.2558	17,343
Marketing Cost	Index	136.3880	3.9734	17,343
Transportation	Index	139.5035	11.2508	17,343
Food Mfg. Wage	Index	202.3916	9.1223	17,343
Num. Competitiors	#	52.3	35.5	17,343
US Inflation	%	2.0626	1.3609	17,343

Table 1: Retail sales and pricing data from Kilts / Nielsen RMS data on an individual-store level. Demographic data are from Kilts / Nielsen HMS data for matching stores and markets. Instrumental variables and cost indices are from U.S. Bureau of Labor Statistics for 2011-2021.

▸ Empirical Model

Data — Evolution of Retail Prices and Min Wage



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Reduced-Form Analysis

- TWFE specification similar to Leung ('21) & Renkin et al. ('22): ▸ Results

$$\ln(\text{price}_{ijt}) = \alpha_i + \beta_t + \gamma \ln(mw_{jt}) + \tau \ln(inf_t) + \lambda \ln(mw_{jt}) * \ln(\text{inf}_t) + \phi X_{jt} + T_j * t + \varepsilon_{ijt} \quad (1)$$

where i = retailer, j = county, t = week, $T_j * t$ are county-specific linear time trends, and X_{jt} = county covariates mentioned before. ▸ Summary Stats

- But MW hikes are a complicated treatment regime
  - *Continuous, time-varying, and on/off treatment with likely dynamic treatment effects*

- Supplement (1) with two 'heterogeneity-robust' ideas from recent literature
  - **'Stacked DiD'** using only the *clean controls* of not-yet-treated states
    - *Cengiz et al., '19; Baker et al., '22; Fone et al., '23*
  - **Continuous and staggered DiD** estimator
    Callaway, Goodman-Bacon, and Sant'Anna ('21)
  - *ongoing …*

Structural Models

Goals

1. Estimate consumers' preferences for food retail stores in a market
2. Evaluate how retailers compete in the market
3. Examine MW pass-through with demand and competition models

Modeling Steps

1. A discrete choice model of market-level demand (*Miravete et al., '22*)
   - *Gives flexible curvature estimates so pass-through can vary with inflation*
2. A Bertrand-Nash model of retail competition (*Richards & Hamilton, '15*)
   - *Controls for market-power in pass-through estimation*
3. Counterfactuals to measure the effect of curvature and market power on pass-through

Step 1: Demand Model

Demand Model — Idea

- Consumers choose retail stores instead of product categories
  - *MW hikes, unlike other cost shocks, impact aggregate store prices, not individual products*
- Build a Mixed Logit discrete choice model of demand
  - ***Goal:** to get flexible substitution patterns & curvature estimates*
- Store choice depends on **store attributes** (#SKUs, % items on display), **income**, **prices**
  - *Income differentiates the choice between high-end and low-priced stores*
- Endogeneity in demand due to prices and exercise of market power
- Identification intuition
  - *Address price endogeneity via an IV method*
  - *Interact income and price levels to recover the demand curvature*

Demand Model

- We follow Miravete, Seim, and Thurk ('23), henceforth MST

- Consumer i chooses store j in week t based on

$$u_{ijt} = x_{jt}\beta_i + f_i(y_i, p_j) + \xi_j + \varepsilon_{ijt}, \qquad i \in \mathcal{I}, j \in \mathcal{J}, \varepsilon_{ijt} \sim \text{EV1}, \tag{2a}$$

$$\beta_i = \beta + \sigma_x \nu_i, \qquad \nu_i \sim N(0, I_n), \tag{2b}$$

$$f_i(y_i, p_j) = \alpha_i(y_i - p_j) = (\alpha + \sigma_p \phi_i) \times (y_i - p_j), \qquad \phi_i \sim \Phi(0, 1). \tag{2c}$$

- Notation:
  - (x_j, ξ_j) denote observed and unobserved store attributes,
  - $p_j =$ store j's price index; $y_i =$ consumer i's income,
  - β_i captures heterogeneity in consumers' valuation of store attributes,
  - f_i represents how spending on the *outside option*, $y_i - p_j$, affects indirect utility. Denote

$$f'_{ij} = \frac{\partial f_i(y_i, p_j)}{\partial p_j} \quad \text{and} \quad f''_{ij} = \frac{\partial^2 f_i(y_i, p_j)}{\partial p_j^2}. \tag{3}$$

Demand Model

- Individual i visits retailer/store j if $u_{ij} \geq u_{ik}, \forall k \in \{1, 2, \ldots, \mathcal{J}\}$.
- EV1 assumption of ε_{ijt} implies i's probability of visiting store j is:

$$\mathbb{P}_{ij}(p) = \frac{\exp(x_j \beta_i + f_i(y_i, p_j) + \xi_j)}{1 + \sum_{k=1}^{\mathcal{J}} \exp(x_k \beta_i + f_i(y_i, p_k) + \xi_k)}. \tag{4}$$

- Individual i makes a dichotomous decision: "visit j" vs. "visit something else".
  - Model visit decisions by a Bernoulli random process with prob. of 'success' $\mathbb{P}_{ij}$
  - **Mean** of the Bernoulli random variable is $\mu_{ij} = \mathbb{P}_{ij}$
  - **Variance** is $\sigma_{ij}^2 = \mathbb{P}_{ij}(1 - \mathbb{P}_{ij})$; non-standardized **skewness** is $sk_{ij} = \sigma_{ij}^2(1 - 2\mathbb{P}_{ij})$.
- Set $G(i)$ as the measure of heterogeneous individuals. Then, total demand for store j is:

$$Q_j(p) = \int_{i \in \mathcal{I}} \mathbb{P}_{ij}(p) dG(i). \tag{5}$$

Demand Model — Elasticity, Curvature, & Manifold

- Own-price demand elasticity of store j is:

$$\epsilon_j(p) = -\frac{p_j}{Q_j(p)} \int_{i \in \mathcal{I}} f'_{ij} \cdot \sigma^2_{ij} dG(i). \tag{6}$$

Intuition: aggregate individual price responses (demand slopes) weighted by choice variance

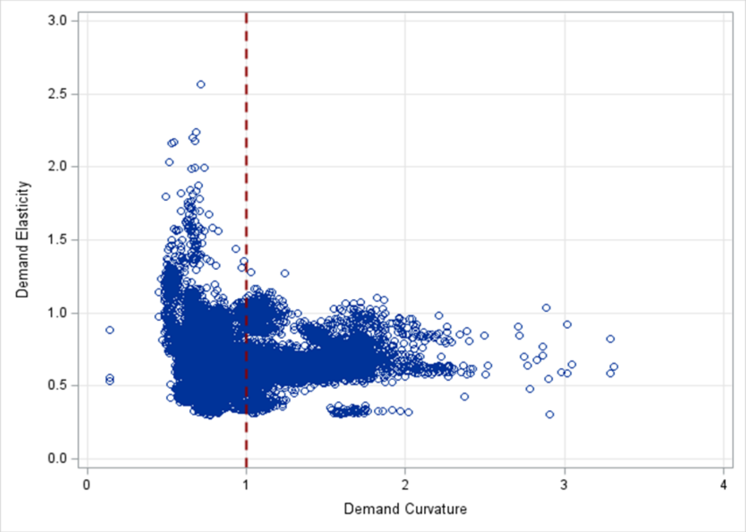
- Demand curvature for our discrete choice model (2) is:

$$\rho_j(p) = \underbrace{\int_{i \in \mathcal{I}} \mu_{ij} dG(i)}_{\text{total store demand}} \times \frac{\int f''_{ij} \cdot \sigma^2_{ij} dG(i) + \int (f'_{ij})^2 \cdot sk_{ij} dG(i)}{[\int f'_{ij} \cdot \sigma^2_{ij} dG(i)]^2}. \tag{7}$$

- Combining elasticity and curvature expressions, we get the expression for mixed logit demand manifold:

$$\rho_j[\epsilon_j(p)] = \frac{p_j^2}{\epsilon_j^2(p) \cdot Q_j(p)} \left[\int_{i \in \mathcal{I}} f''_{ij} \cdot \sigma^2_{ij} dG(i) + \int_{i \in \mathcal{I}} (f'_{ij})^2 \cdot sk_{ij} dG(i) \right]. \tag{8}$$

Illustration of Demand Manifold



Demand Model — Identification

- We follow MST and Gandhi & Houde ('20) for identifying demand curvature
- Consider inverse demand for retailer ψ^{-1} with attributes x_j and prices p_j:

$$\psi_j^{-1}(s_t, x_t, p_t; \theta) = h(\omega_{jt}; \theta) + C_t(\theta), \tag{9}$$

  - s_t = *retailer market shares in market t,*
  - x_t = *vector of retailer attributes (**exogeneous**)* ▸ Attributes ; p_t = *prices (**endogeneous**)*
  - θ = *vector of demand parameters to be estimated,*
  - $C_t(\theta)$ = *market specific constant;* ω_{jt} = *market-state vector summarizing market competition*
  - $\omega_{jt} = \{s_{kt}, d^x_{j,kt}, d^p_{j,kt}\}$
  - $d^x_{j,kt} = x_{jt} - x_{kt}$ = distance in attribute space of stores k and j; exogeneous, but
  - $d^p_{j,kt} = p_{jt} - p_{kt}$ = distance in price space of stores k and j; endogeneous.

Demand Model — Identification

- Price endogeneity: unobs. demand shocks ξ in (2) can confound MW-price effects

  Idea: get exogeneous price predictions via hedonic price regressions

- For store attributes x_{jt} and market-level cost shocks w_{jt}, ▸ Shocks fit prices based on

$$p_{jt} = \gamma_0 + \gamma_1 x_{jt} + \gamma_2 w_{jt} + v_{jt} \tag{10}$$

- Construct 'Differentiation IVs' in price-space between store j & its competitors:

$$Z^p_{jt} = \sum_r (\hat{p}_{rt} - \hat{p}_{jt})^2. \tag{11}$$

- Exogeneous instruments due to exogeneity of attributes and cost shocks

  Not subject to usual criticism of 'Hausman instruments'

- Apply a control-function framework and SML estimator in mixed logit model

Step 2: Pricing Model

Pricing Model — Idea

- Consumer side: greater heterogeneity in consumers' WTP implies more curvature, higher pass-through rates

- Retailer side: As MW increases, retailers 'give-up' low WTP consumers by raising prices for higher WTP consumers
  - *In essence, retailers are exploiting demand curvature*

- Cournot (1838): For monopolists with constant returns to scale and inverse demand $p(q)$, pass-through rate is:

$$\frac{dp}{dc} = \frac{1}{2 - \rho(q)} > 0, \tag{12}$$

  - $\rho(q) = -q \cdot \frac{p_{qq}(q)}{p_(q)} =$ inverse demand curvature
  - Pass-through $<$ 100% if demand is log-concave ($\rho < 1$); exceeds 100% for log-convex demand ($\rho > 1$).
  - Take away: Pass-through is **fully defined** by curvature. But is curvature always enough?

Pricing Model — Weyl & Fabinger ('13)

- No, curvature is not enough in imperfect competition!
- Weyl & Fabinger ('13): For n symmetrically differentiated oligopoly retailers with demand $p(q)$ and marginal cost $c(q)$, pass-through is:

$$\phi = \frac{1}{1 + \frac{\theta}{\varepsilon_\theta} + \frac{\varepsilon_D - \theta}{\varepsilon_S} + \theta(1-\rho)} \tag{13}$$

- $\underbrace{\varepsilon_S = c'(q)(p/q)}_{\text{elasticity of supply}}$; $\underbrace{\varepsilon_\theta = (d\theta/dq)(q/\theta)}_{\text{conduct-output elasticity}}$; $\underbrace{\rho = p_q(q)/(qp_{qq}(q))}_{\text{demand curvature}}$
-

$$\theta = \underbrace{\frac{p(q)-c(q)}{p(q)} \cdot \varepsilon_D}_{\text{conduct parameter}} = \begin{cases} 0, & \text{perfect competition} \\ 1, & \text{monopoly} \\ 1/n, & \text{Cournot} \\ 1 + \sum_{i \neq j}(\partial q_j/\partial p_i)/(\partial q_i/\partial p_i), & \text{Bertrand-Nash} \end{cases} \tag{14}$$

Pricing Model — W&F Insights

- Pass-through for a symmetric differentiated oligopoly is defined by
  - degree of competition, θ
  - demand curvature, ρ, and
  - structure of cost and demand, ε_S and ε_θ.
- For constant marginal cost ($\varepsilon_S = 0$) and linear demands $(\rho = 0)$
  - constant monopoly conduct $(\theta = 1,\ \varepsilon_\theta = 0)$, means pass-through $\phi = 1/2$
  - competitive conduct $(\theta = 0)$ implies $\phi = 1$, that is **100% pass-through**
- For log-convex demand ($\rho > 1$), all else equal:

  $\phi > 1$, *that is costs are* ***over-shifted***
- For log-concave demand ($\rho < 0$), all else equal:

  $\phi < 1$, *that is* ***firms absorb some of cost*** *increase as lower margins*
- Summary: In log-convex case, curvature interacts with market power to over-shift

Pricing Model — Incorporating Search in W&F

- Increased search during inflation but less effective (Tappata '09; Lewis '11).
- Retailers exploit uncertainty to pass-through costs as inflation allows them to hike prices.
- Integrating consumer search into the W&F pass-through model is challenging as search-literature is based on *mixed* strategies, and W&F on *pure* strategies.
- Our proposal: include a price-dispersion parameter that proxies inflation. Search in W&F pass-through:

$$\phi = \frac{1}{1 + \frac{\theta}{\varepsilon_\theta} + \frac{\epsilon_D - \theta}{\epsilon_S} + \theta(1-\rho) - \frac{\epsilon_D}{\epsilon_T}\frac{T(q)}{p(q)}} \tag{15}$$

- Here $\epsilon_T = \frac{T(q)}{T'(q)\cdot q}$ is the search-elasticity, and $T(q)$ is number of searchers in quantities.
- Equation (15) implies higher search intensity **increases** pass-through.

Pricing Model

- Retailers play Bertrand-Nash game & maximize profits by choosing store-level prices
- The profit equation for retailer j is:

$$\Pi_j = Q_j(p_j - c_j) - F_j, \tag{16}$$

  - Q_j = total retailer demand from demand model
  - c_j = marginal cost of producing & selling groceries
  - F_j = retailer's fixed cost of selling items in all categories

- Marginal cost is linear in input prices:

$$c_j(\mathbf{v}_j) = \sum_{l \in L} \eta_{wl} v_{jl} + \epsilon_j, \tag{17}$$

  - $\mathbf{v}_j$ = vector of L input prices, ϵ_j = iid error term.

Pricing Model

- Optimal price for retailer j's profit maximization is based on FOC:

$$\frac{\partial \Pi_j}{\partial p_j} = Q_j + (p_j - c_j)\frac{\partial Q_j}{\partial p_j} = 0, \ \forall j \in \mathcal{J}, \tag{18}$$

- Stacking FOC for all retailers in each market, Bertrand-Nash price equilibrium condition is:

$$\mathbf{p} = \mathbf{c} - \theta(\mathbf{Q}_p)^{-1}\mathbf{Q} + \epsilon \tag{19}$$

- $\mathbf{Q}_p$ = matrix of retailer-volume derivatives with elements $\partial Q_j / \partial p_j$

- θ = conduct parameter that measures deviation from the BN-game

  captures the effect of market power on pass-through

- $\theta = 1$ means retailers compete as BN rivals; $\theta = 0$ implies perfect competition

Step 3: Impact of Curvature on Pass-through

Impact of Curvature on Pass-through

- Research questions:
  - What is the pass-through rate of MW increases to retail prices in low- and high-inflation regimes?
  - How do demand curvature and market power affect these pass-through rates?
  - How competitive are grocery retailers?
- Estimate the Bertrand-Nash price equilibrium model to recover values of θ
- Estimate the change due to MW changes as function of θ and ρ from demand model
- Ultimately, use counterfactual-simulations of pricing model to calculate pass-through

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TWFE Estimates

▸ TWFE Specification

Dependent Variable: Log Price Index	(1)	(2)
Log Min Wage	0.3237***	0.0814
	(0.0618)	(0.0542)
Log Min Wage × Log Avg. Inflation	0.0324**	0.0206**
	(0.0128)	(0.0103)
Retailer & Time Fixed Effects	✓	✓
Covariates	✓	✓
Retailer-Specific Time Trends		✓
R-squared	0.9664	0.9826

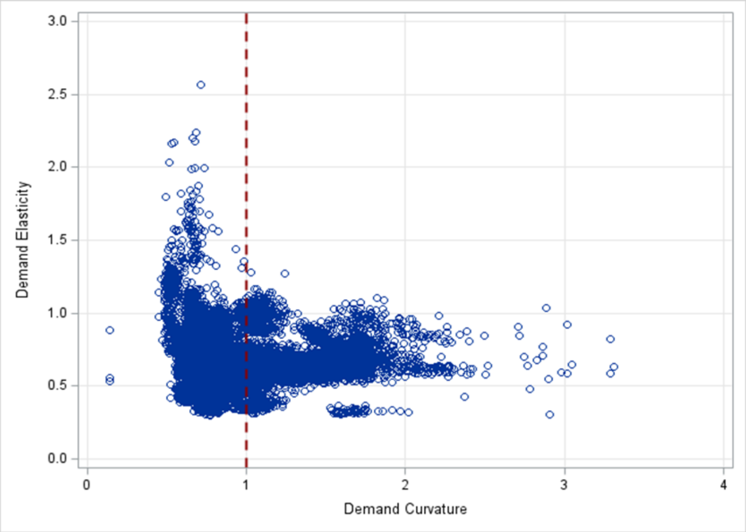
Table 2: Sig. level *** $p < 0.01$; ** $p < 0.05$. Standard errors are clustered by state.

Structural Estimates: Mixed-Logit Demand Model

Variable	Model 1	Model 2
Constant	-7.0826*** (0.0553)	-4.1905*** (0.1112)
Feature	0.3097*** (0.0198)	0.2764*** (0.0179)
Display	-0.2377*** (0.0150)	-0.2796*** (0.0108)
Variety	0.1370*** (0.0015)	0.1536*** (0.0011)
Num. Stores	0.7570*** (0.0049)	0.4577*** (0.0061)
CF*Price	0.0637*** (0.0012)	0.0764*** (0.0012)
Price	-0.4746*** (0.0087)	-0.2114*** (0.0178)
Price (Inc)	N.A. (N.A.)	-0.0043*** (0.0008)
Weeks FE?	Yes	Yes
Years FE?	Yes	Yes
Retailers FE?	Yes	Yes
N	17,343	17,343
LLF	5,077.00	5,453.51
AIC	-0.5793	-0.6227

Table 3: Model 1 adds a control function, Model 2 adds random parameters and interaction of marginal utility of income with household-income draw. Sig. level *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Structural Demand Estimates — Demand Manifold



Implied Estimates from Demand Model

- Estimated price elasticity:
    - ϵ = -0.665 (standard deviation = 0.183)
    - Store demand inelastic
- Estimated demand curvature:
    - ρ = 0.997 (standard deviation = 0.339)
    - Demand includes range of log-concave and log-convex

Structural Estimates: Bertrand-Nash Pricing Model

Variable	Model 1	Model 2	Model 3
Retail Wage	0.0105 (0.0081)	0.0060 (0.0019)	0.0067*** (0.0001)
Minimum Wage	0.0798 (0.0843)	0.0325 (0.0194)	0.0232*** (0.0024)
Conduct	-2.3022*** (0.7776)	0.5693*** (0.2414)	0.5766*** (0.0375)
Month Fixed Effects	No	No	Yes
Retailer Fixed Effects	No	Yes	Yes
R-squared	0.1042	0.9426	0.9464
F	673.61	6,194.53	5,372.60

Table 4: Model 1 is the base model with only retail wages, minimum wages and markup term. Model 2 & 3 add retailer and month fixed effects. Standard errors clustered at the market level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Summary of Pricing and Pass-through Estimates

Variable	Base Value	New Equilibrium
Minimum Wage	9.2339*** (1.8642)	18.4678*** (3.7284)
Retail Price	3.5575*** (1.0113)	3.7712*** (1.0176)
Markup	1.3749*** (0.1137)	1.7714*** (0.8806)
Market Share	0.0616*** (0.0101)	0.0232 (0.0465)
Passthrough (%)	0.0597*** (0.0010)	
Curvature	1.0239*** (0.3514)	
Elasticity	-2.6038*** (0.7428)	

Table 5: All estimates based on flexible demand-model estimates in Table 3. All estimates at sample-average values. Standard error in parenthesis. Minimum wage simulation shocks wage by 100% as in Miravete, Seim, and Thurk (2023b) so the pass-through value is interpreted as an elasticity.

Pass-through Relationship with Curvature and Inflation

Variable	Model 1	Model 2	Model 3
Constant	0.0045 (0.0050)	-0.0099 (0.0053)	0.0021 (0.0053)
Inflation	0.0786*** (0.0203)	N.A.	N.A.
Curvature	N.A.	0.0054*** (0.0013)	0.0043*** (0.0013)
Month Fixed Effects	Yes	No	Yes
Retailer Fixed Effects	Yes	Yes	Yes
R-squared	0.9283	0.9265	0.9284
F	4,088.58	4,970.34	4,087.46

Table 6: All models estimated using pass-through estimates from Bertrand-Nash pricing model in Table 4. Curvature estimated from demand model using expressions from Miravete, Seim, and Thurk (2023). All models estimated with standard errors clustered at the market level. Models 1 examines inflation effect while Models 2 and 3 examine curvature. Models 2 is estimated without month fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Brief Discussion

- What do these estimates mean?
  - Retailers, on average, are very competitive
  - Strategic obfuscation goes away after controlling for the structure of demand and competition
  - Curvature remains as an important determinant of minimum-wage pass-through
- Pass-through is ’roughly complete’ at Wage-price elasticity of 0.06
- Little evidence of over-shifting as in Leung (2021) with different approach
- Minimum-wages not likely to be undershifted either as in Renkin, et al. (2022)
- Validation of pass-through estimation method

Roadmap of Talk

Conclusion

- Pass-through is complicated
  - Depends on structure of demand
  - Depends on structure of competition
  - Depends on other, maybe behavioral factors (inflation)
- We estimate minimum-wage pass-through in grocery stores
  - We find that pass-through is generally complete
  - Pass-through falls in inflation as retailers become more competitive
  - Pass-through increases in demand curvature, as predicted by Weyl-Fabinger
  - Minimum wages may be over-shifted into retail prices
- Implications for policy?
  - Concentration and conduct only loosely related
  - Retailer play Bertrand game, not Cournot