



Meal Clicks: The Effects of an Unhealthy Tax on Food-Away-From-Home Demand and Dietary Outcomes

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Background and Motivation

Literature Gap

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- Food taxes are among the most common fiscal policy tools aims to
 - reduce the consumption of unhealthy foods (e.g., sugar-sweetened beverage (SSB) and candy taxes),
 - discourage the intake of undesirable nutrients (e.g., sugar and fat taxes)
 - target obesity more broadly (e.g., calorie-based taxes).
 - A growing body of literature has evaluated the effects of these taxes on
 - consumer food demand (Caputo and Just, 2020; Ahn and Lusk, 2020; Zhen et al., 2023),
 - dietary and health outcomes (Smed et al., 2007; Allais et al., 2010)
 - unintended consequences such as regressive nature (Chouinard et al., 2007; Engber, 2009; Madden, 2015).
 - However, most of this research has focused on food-at-home (FAH) contexts, while the impact of food taxes on food-away-from-home (FAFH) consumption remains understudied, especially in the rapidly growing context of online meal ordering.

Background and Motivation

Why Study Food Taxes in Online FAFH Settings?

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- **Context matters:** The effectiveness of food taxes is context-dependent (Caputo & Just, 2020).
 - **Rapid Growth of Online FAFH:** Online FAFH has experienced the fastest growth among FAFH channels globally, with delivery revenues rising 50% from 2019 to 2020 and reaching \$425 billion in 2024 (13% of FAFH) (Statista Market Insights, 2025).
 - **Challenges in online FAFH platforms:**
 - High prevalence of unhealthy options (Fernandez & Raine, 2021; Wang et al., 2021)
 - Linked to increased consumption of calorie-dense, nutrient-poor meals (Dai et al., 2022; Saleh et al., 2024)
 - **Opportunities for greater impact:**
 - In FAH settings, food taxes often have low salience—consumers may not notice them
 - Online platforms can enhance salience through design and interactive features, improving policy effectiveness

Objectives

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- This study evaluates the effects of an unhealthy food tax in the online FAFH context, with a focus on both fast food and non-fast-food restaurants. Specifically, we assess:
 - impacts on consumer food demand
 - impacts on nutrient intake
 - heterogeneous effects across income groups
 - tax burden and regressiveness

Objectives

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- **This study conducted a large-scale, incentivized online experiment across the U.S.**
 - Developed a mock-up food delivery app simulating a realistic online FAFH environment
 - Embedded an extended basket-based choice experiment (BBCE) allowing multiple dish and quantity selections (adapted from Caputo & Lusk, 2020)
 - **Incentive Design:**
 - Based on Ahles et al. (2024)'s small-probability incentive approach using the BDM mechanism
 - Respondents randomly assigned to a 1% or 10% binding probability group
 - Aims to reduce hypothetical bias while maintaining large-scale reach

Experiment Design

Treatment Conditions

Between-subjects design

- 2 types of restaurants
- 2 tax conditions

Tax Conditions	Restaurant Types	
	Fast Food	Fine Dining
Without Tax	Fast Control (N=874)	Fine Control (N=892)
With Tax	Fast Tax (N=840)	Fine Tax (N=907)

Unhealthy Tax

- **Tax scope:** dishes exceed any of the three thresholds
 - calorie density > 275 kcal/100 grams of dish
 - saturated fat > 4 grams/100 grams of dish
 - sugar > 10 grams/100 grams of dish
- **Tax amount:** 20% of unhealthy food item price
- **Tax display format:** “A \$X unhealthy tax will be added.”

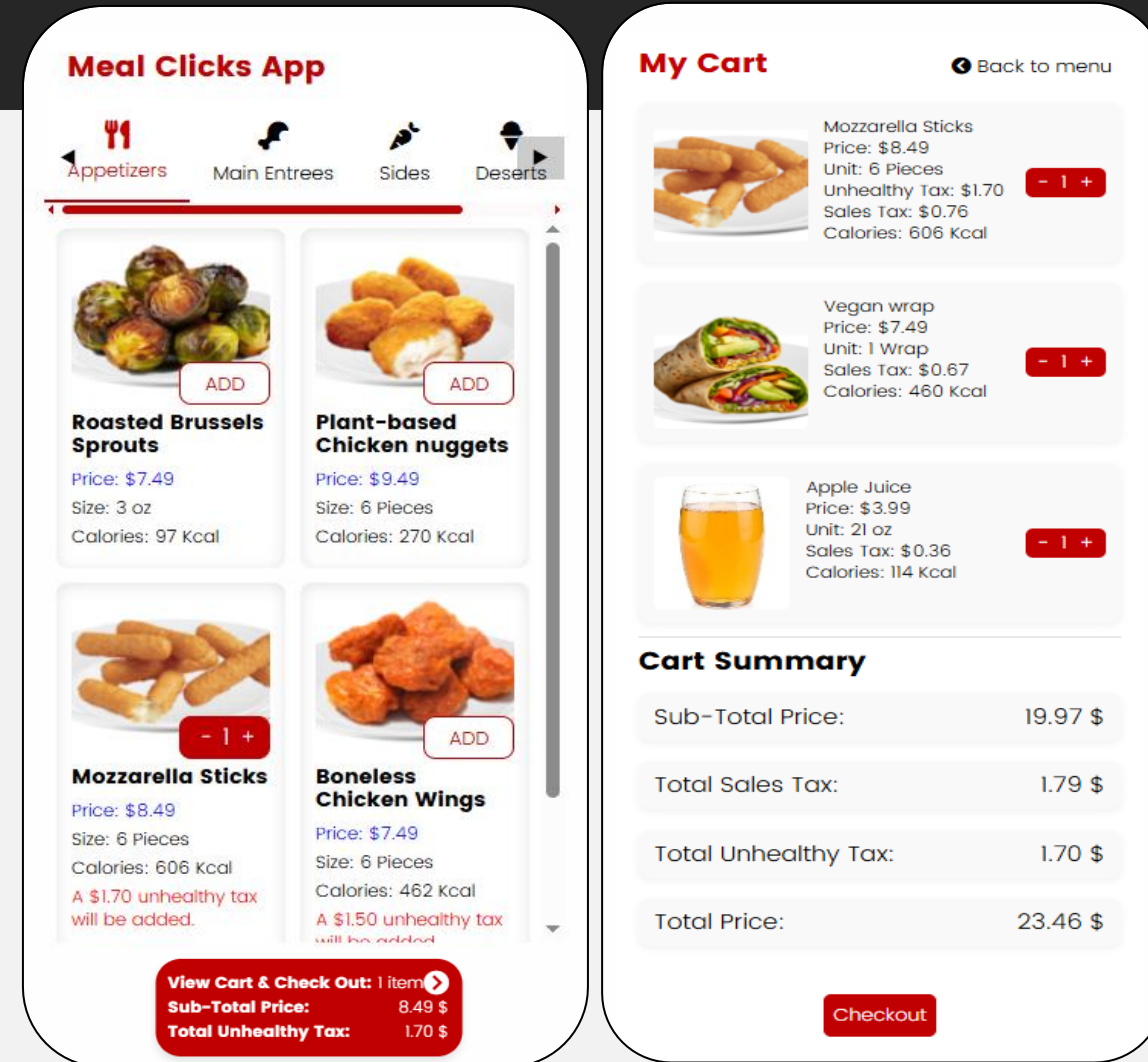


Figure 1. Food Delivery App Mock-Up

Experiment Design

Extended BBCE

▪ Fast Food Restaurants

- 9 Burgers (6 taxed)
- 4 Sandwiches (2 taxed)
- 3 Snacks (2 taxed)
- 2 Sweets (2 taxed)
- 3 Drinks (1 taxed)

▪ Fine Dining Restaurants

- 4 Appetizers (2 taxed)
- 9 Main Entrées (4 taxed)
- 3 Sides (1 taxed)
- 2 Desserts (1 taxed)
- 3 Drinks (1 taxed)

▪ Orthogonal fractional factorial design

- 72 menus choice scenarios
- Eight blocks
- Respondents randomly assigned to one block.
- Each respondent was presented the mock-up delivery apps nine times.

Result 1- Extended Multiple Discrete-Continuous (eMDC)

Unhealthy Tax Impact on Food Demand

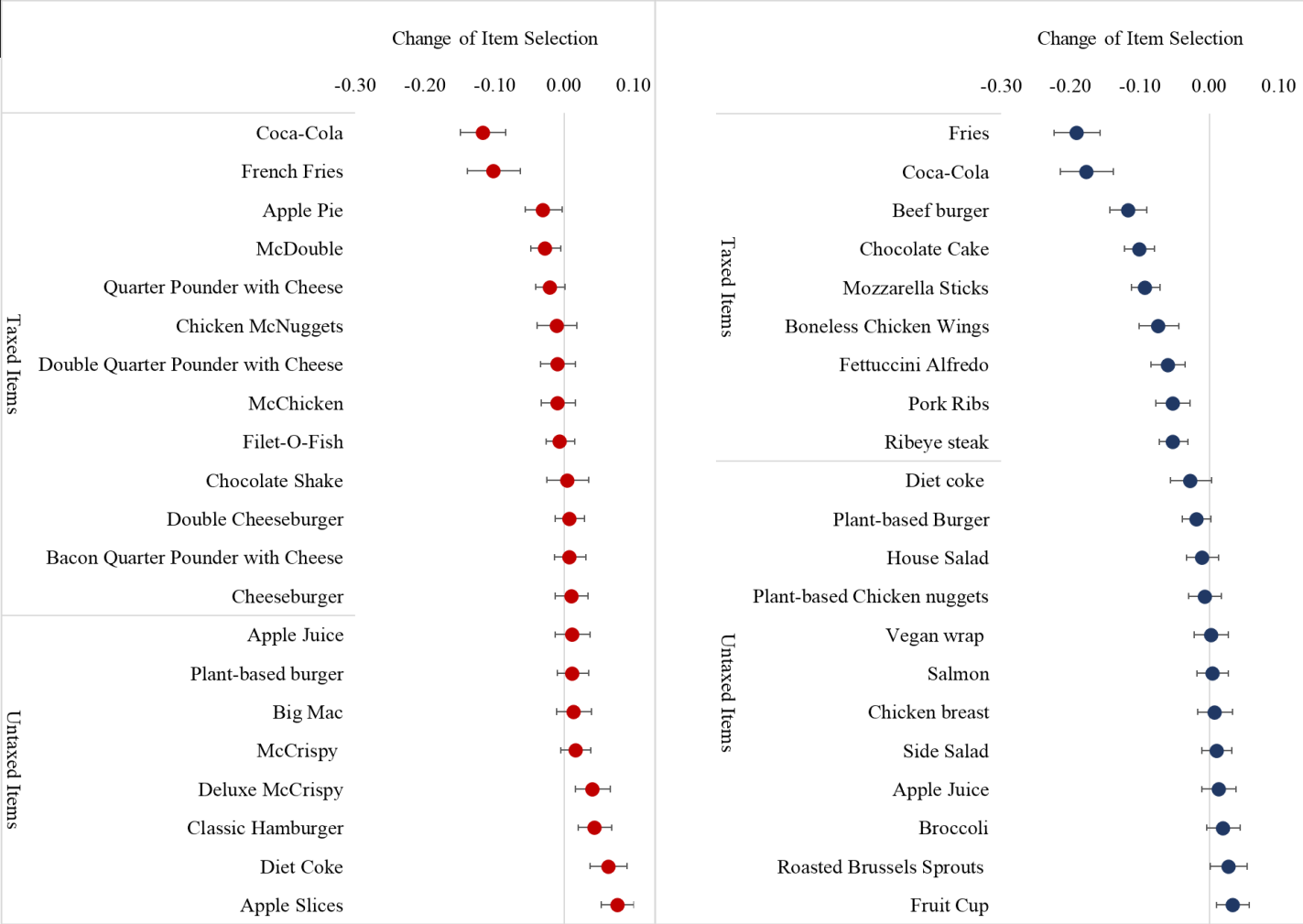
Fast-food restaurants:

- Taxed Items:
 - (-) Coca-Cola, French fries, apple pie, and the McDouble
- Untaxed Items:
 - (+) apple slices, Diet Coke, the classic hamburger, and the Deluxe McCrispy

Fine-dining restaurants:

- (-) all taxed items
- Untaxed Items:
 - (+) fruit cup and roasted Brussels sprouts

Unhealthy Tax has a larger impacts in fine-dining food demand.



Panel A. Fast Food

Panel B. Fine Dining

Figure 2. Changes in Dish Selection With and Without Tax

Result 2- Extended Multiple Discrete-Continuous (eMDC)

Heterogenous Unhealthy Tax Impact on Food Demand Across Income

Low-income households

- Taxed Items: (-) Coke, fries, chocolate shake, and chicken nuggets
- Untaxed items: (-) Big Mac and McCrispy

Medium-income households

- Taxed Items: (-) Coke, fries, apple pie, McDougle, and chicken nuggets
- No impact on untaxed items

High-income households:

- Taxed Items: (+) McChicken, chicken nuggets, and cheeseburger.

Unhealthy Tax has a larger impacts on lower income households

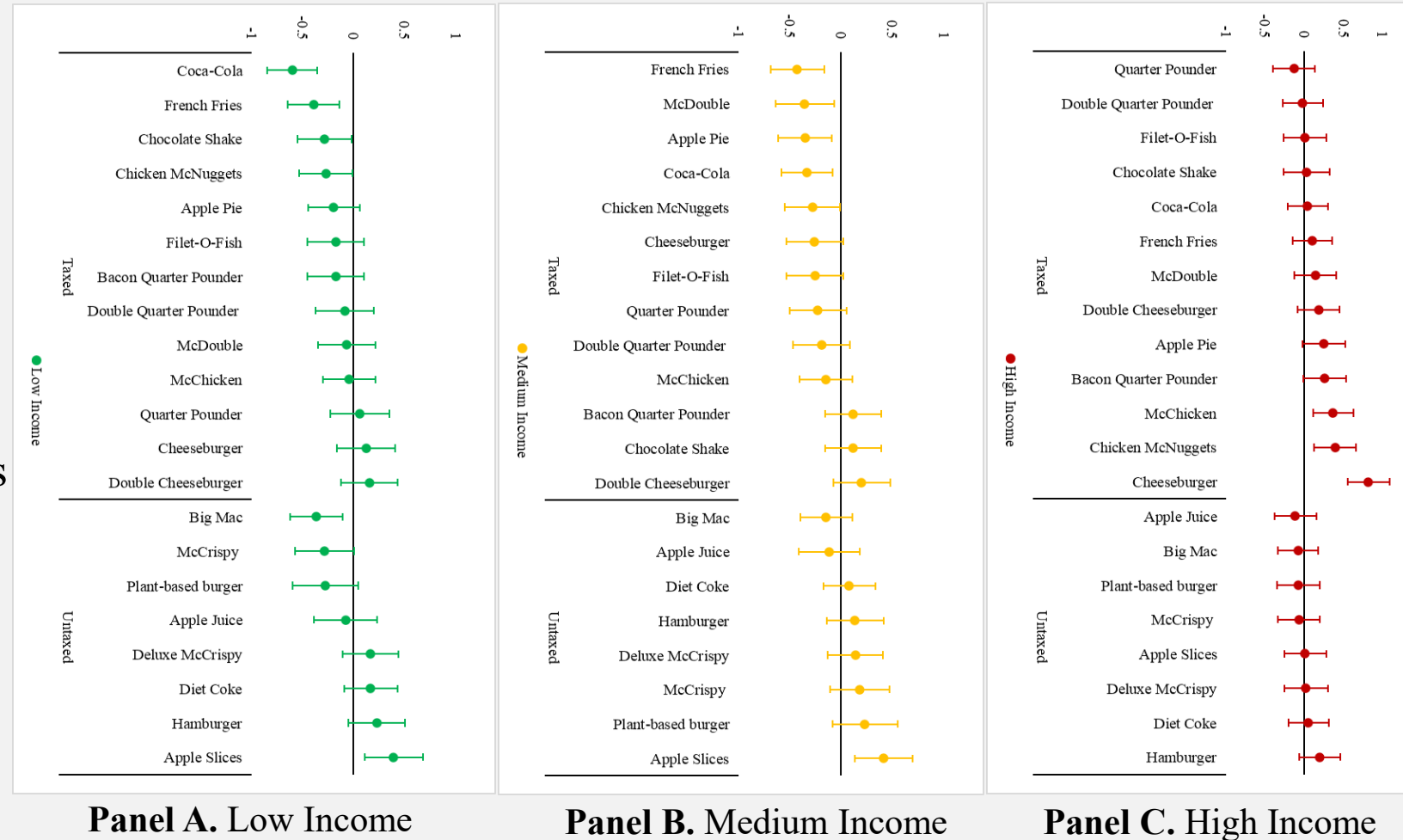


Figure 3. Unhealthy Tax Impacts In Fast Food Restaurant, Across Income

Result 3 - OLS regressions

Unhealthy Tax Impact on Dietary Outcome

Fast food restaurants:

- (-) sugar content by 13.77 grams (11% of the total sugar per order in the fast control group)
- no significant effects on calorie intake, calorie density, saturated fat, or total fat.

Fine dining restaurants:

- (-) calories (-344.1 kcal, 12%)
- (-) calorie density (-0.04 kcal/g, 2%)
- (-) saturated fat (-6.56 g, 13%)
- (-) total fat (-18.94 g, 12%)
- (-) sugar (-17.30 g, 17%)

The effects are more pronounced in fine dining restaurants.

Table 1. Impact of tax implementation on order nutrients

	Calorie (kcal)	Calorie Density (kcal/g)	Saturated Fat (g)	Fat (g)	Sugar (g)
Panel A. Fast Food					
Tax Effect	-142.5 (113.3)	0.0191 (0.0219)	-1.554 (1.610)	-5.620 (5.262)	-13.77*** (5.131)
Panel B. Fine Dining					
Tax Effect	-344.1*** (97.35)	-0.0441** (0.0201)	-6.559*** (1.825)	-18.94*** (5.444)	-17.30*** (3.983)

Note: Demographic controls are included.

Result 4 - Suits Index

Unhealthy Tax Burden and Regressiveness

- In both fast food and fine dining:
 - higher-income individuals pay more in total tax
 - but the tax takes up a larger share of the budget for lower-income consumers
- Unhealthy taxes are regressive, as measured by the Suits Index (Suits, 1977; Berry, 2019; Zhu et al., 2022)
 - Fast food: Suits Index = -0.228
 - Fine dining: Suits Index = -0.289 (more regressive)

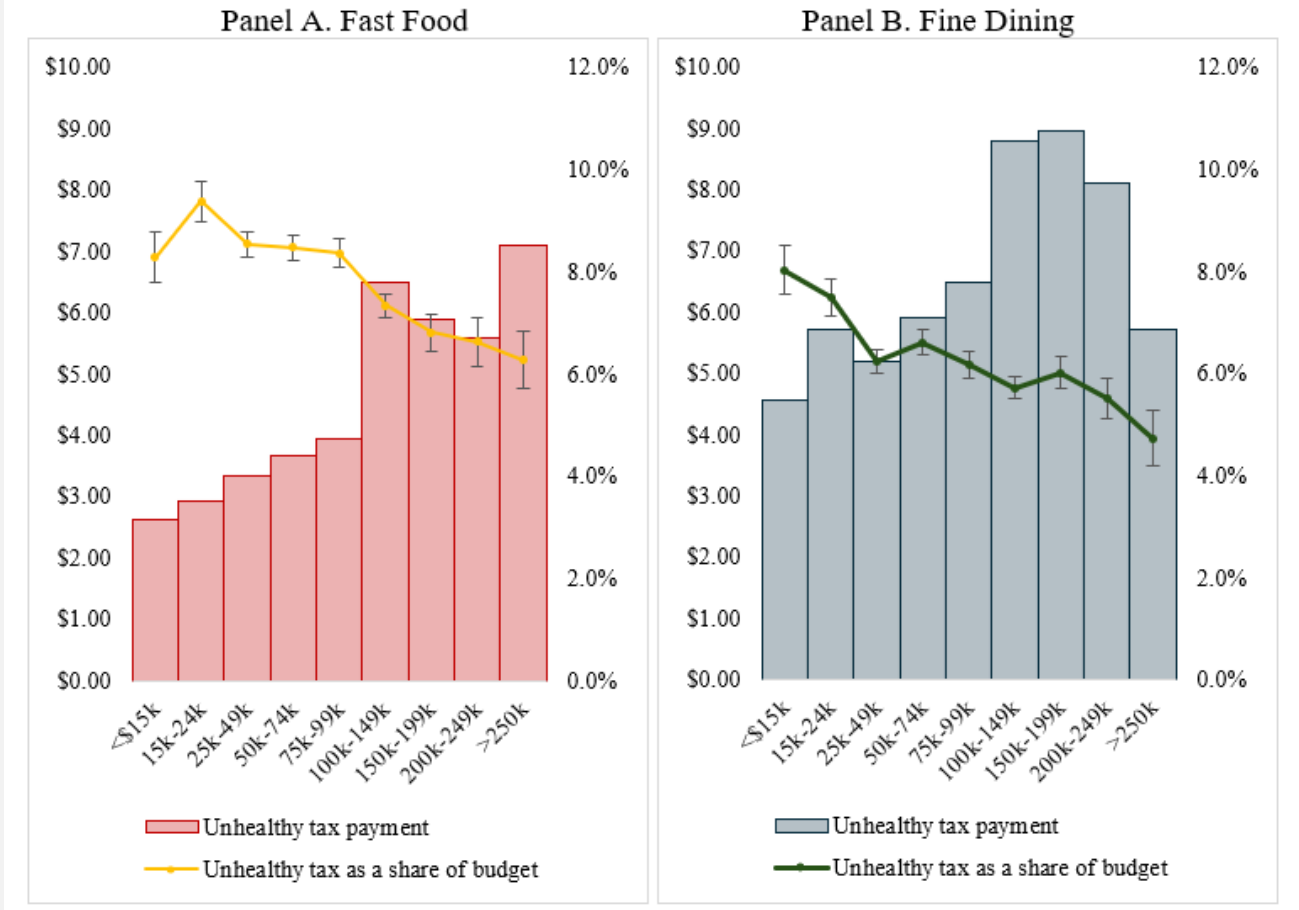


Figure 4. Tax burden by income groups

Conclusion

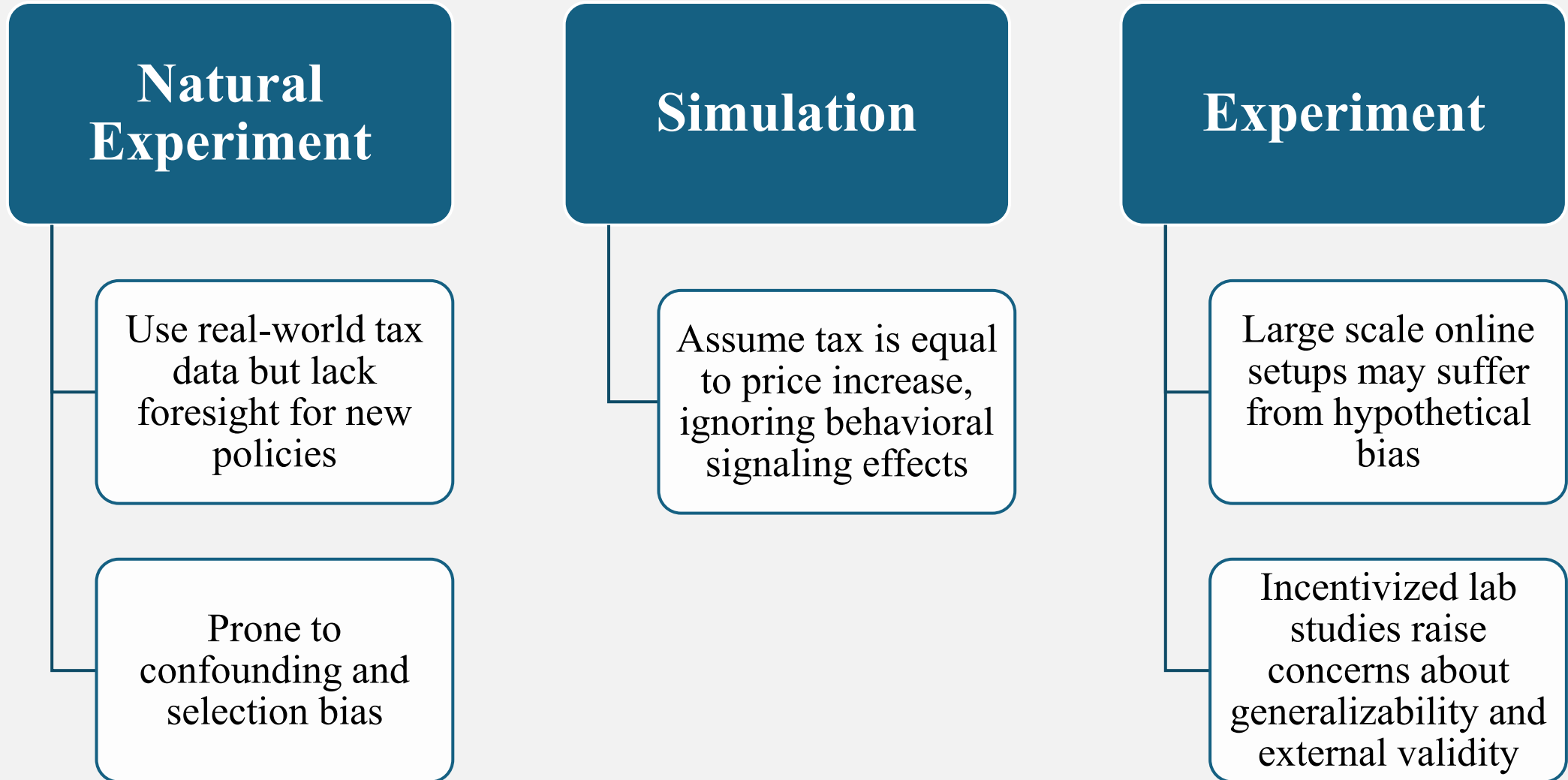
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- Unhealthy taxes are more effective in fine-dining restaurants than in fast food restaurants at shaping food demand and improving dietary quality.
 - Unhealthy taxes are more effective in influencing the food choices of low-income households compared to high-income households.
 - However, unhealthy taxes are regressive and place a greater tax burden on low-income populations, especially in fine-dining settings.

Thank you for your attention.

Question and comments are welcome!

Background and Motivation

Widely Used Method and Limitation



Appendix

Table 4. Summary statistics of food expenditure and consumption

	Fast Food			Fine Dining		
	Control	Tax	<i>p</i> -values	Control	Tax	<i>p</i> -values
Expenditure (\$)						
Pre-tax bill	35.32 (0.43)	35.34 (0.49)	0.976	76.54 (0.85)	67.79 (0.75)	<0.001
Post-tax bill	35.32 (0.43)	39.73 (0.55)	<0.001	76.54 (0.86)	74.40 (0.83)	0.072
Taxed items consumption						
Purchase rate	89.57% (0.003)	85.99% (0.004)	<0.001	87.64% (0.004)	79.78% (0.004)	<0.001
Quantity	5.13 (0.06)	4.84 (0.06)	<0.001	4.31 (0.05)	3.39 (0.04)	<0.001
Pre-tax spends (\$)	24.58 (0.29)	23.57 (0.34)	0.025	44.84 (0.54)	35.54 (0.47)	<0.001
Post-tax spends (\$)	24.58 (0.29)	27.97 (0.40)	<0.001	44.84 (0.54)	42.15 (0.55)	<0.001
Untaxed items consumption						
Purchase rate	68.5% (0.005)	70.9% (0.005)	0.002	80.68% (0.004)	81.62% (0.004)	0.125
Quantity	2.20 (0.03)	2.48 (0.04)	<0.001	3.46 (0.04)	3.52 (0.04)	0.314
Spends (\$)	10.74 (0.19)	11.76 (0.21)	<0.001	31.70 (0.45)	32.25 (0.42)	0.374

Note: For the control group, the post-tax bill and post-tax spends are the same as the pre-tax bill and pre-tax spends, respectively, since the unhealthy tax was not implemented in the control group.

Appendix

Table 5. eMDC model estimates for fast food restaurant

	Base Utility ($\beta_{0,k}$)	Satiation Effect (γ_k)	Tax Effect ($\beta_{tax,k}$)
Taxed Items			
French Fries	-0.800*** (0.055)	0.389*** (0.033)	-0.289*** (0.075)
Chocolate Shake	-2.632*** (0.060)	0.528*** (0.061)	-0.014 (0.082)
Chicken McNuggets	-2.659*** (0.056)	0.592*** (0.062)	-0.016 (0.079)
Coca-Cola	-2.832*** (0.052)	0.509*** (0.049)	-0.317*** (0.074)
Double Quarter	-2.953*** (0.056)	0.957*** (0.102)	-0.099 (0.081)
Bacon Quarter	-3.370*** (0.057)	1.011*** (0.111)	0.059 (0.081)
Filet-O-Fish	-3.398*** (0.057)	0.736*** (0.089)	-0.138 (0.082)
McChicken	-3.824*** (0.054)	0.687*** (0.070)	0.053 (0.076)
Quarter	-3.501*** (0.058)	0.988*** (0.118)	-0.118 (0.083)
Apple Pie	-3.607*** (0.056)	0.536*** (0.060)	-0.066 (0.078)
McDouble	-4.115*** (0.058)	0.923*** (0.102)	-0.104 (0.082)
Double Cheeseburger	-4.216*** (0.058)	0.946*** (0.105)	0.167** (0.081)
Cheeseburger	-4.630*** (0.058)	0.954*** (0.099)	0.213*** (0.081)

Untaxed Items

Big Mac	-2.951*** (0.053)	0.862*** (0.085)	-0.223*** (0.075)
Deluxe McCrispy	-3.117*** (0.059)	0.721*** (0.079)	0.105 (0.081)
McCrispy	-3.594*** (0.060)	0.727*** (0.086)	-0.045 (0.083)
Plant-based burger	-3.619*** (0.057)	1.065*** (0.125)	-0.036 (0.089)
Diet Coke	-3.950*** (0.055)	0.582*** (0.063)	0.101 (0.076)
Apple Juice	-4.654*** (0.062)	0.634*** (0.074)	-0.092 (0.087)
Hamburger	-5.172*** (0.059)	0.991*** (0.099)	0.180** (0.081)
Apple Slices	-5.199*** (0.061)	0.664*** (0.074)	0.246*** (0.083)
10% incentive (α)	0.072*** (0.008)		
σ	2.657*** (0.007)		

Appendix

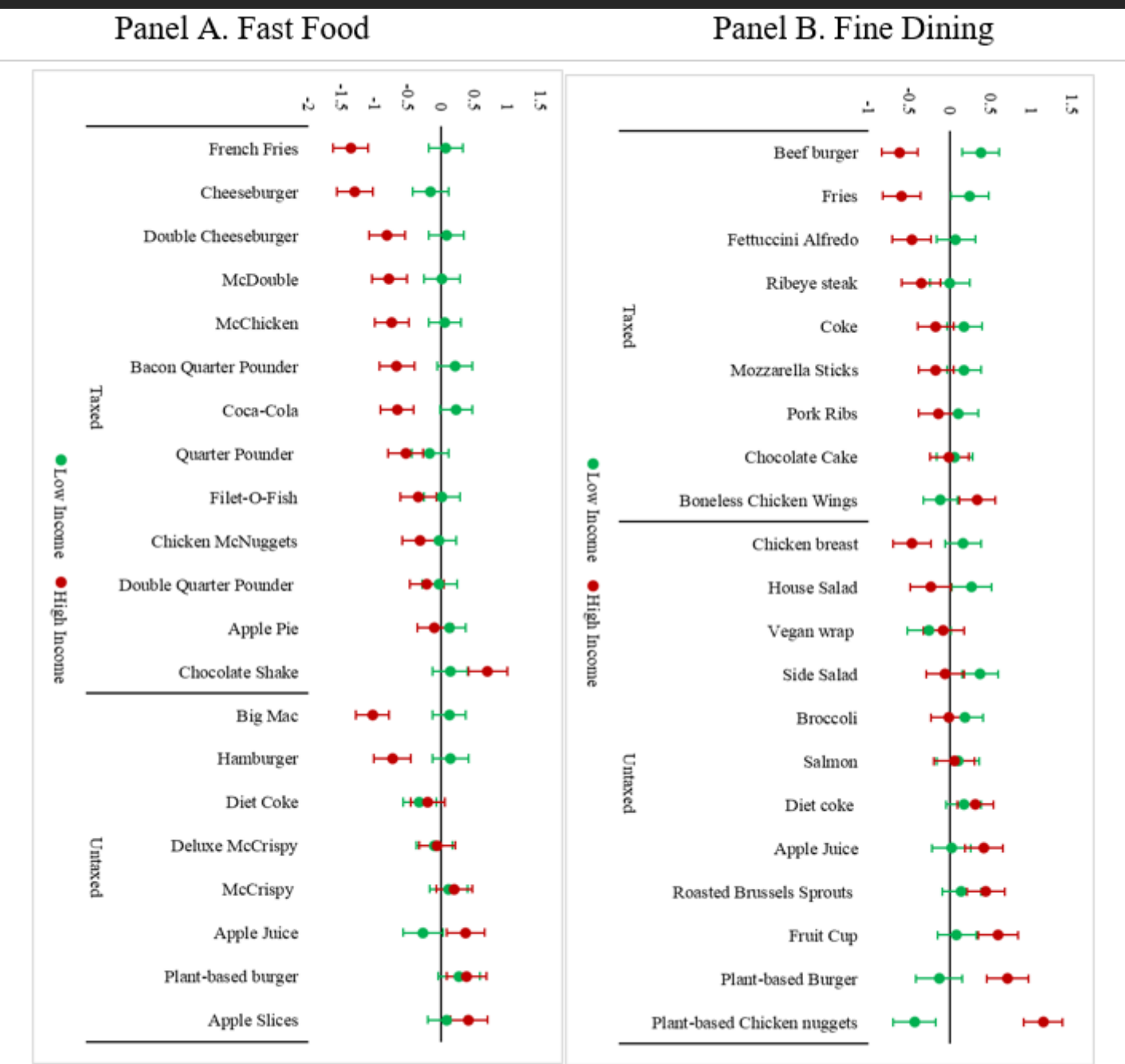
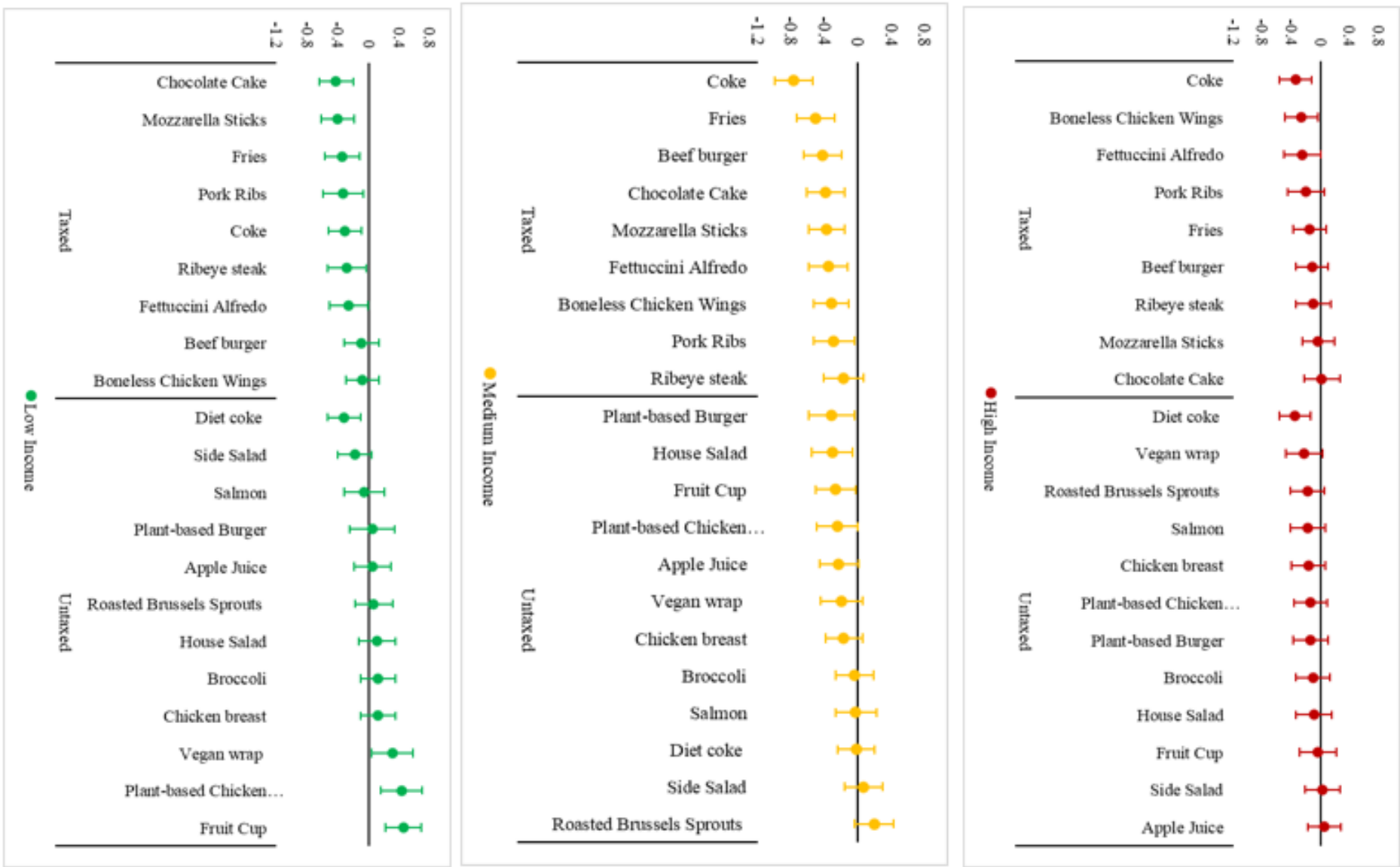


Figure 3. Heterogeneous Baseline Utilities of Food Items Across Income Groups

Appendix



Panel B. Fine Dining

Figure 4. Heterogeneous Tax Effects Across Income Groups

Appendix

Table 9. Heterogenous Treatment Effects on Dietary Quality

	Fast Food					Fine Dining				
	Calorie (kcal)	Calorie Density (kcal/g)	Saturated Fat (g)	Fat (g)	Sugar (g)	Calorie (kcal)	Calorie Density (kcal/g)	Saturated Fat (g)	Fat (g)	Sugar (g)
Tax Group (θ^L)	-212.1*	0.0553	-2.414	-8.701*	-17.38***	-333.3**	-	-6.702**	-19.35**	-
	(112.4)	(0.0394)	(1.594)	(5.265)	(5.636)	(141.3)	0.0772**	(2.641)	(7.704)	17.26***
Income (Low as Baseline)										
Medium	99.32	0.0362	1.688	5.647	2.304	107.4	-0.0165	2.327	5.913	2.009
	(113.7)	(0.0401)	(1.588)	(5.196)	(6.711)	(161.3)	(0.0366)	(3.040)	(9.048)	(7.613)
High	545.7**	-0.0455	7.787**	23.91**	24.13**	73.93	-	1.740	6.953	-3.359
	(217.4)	(0.0402)	(3.076)	(10.11)	(9.908)	(222.9)	0.106***	(4.081)	(12.55)	(8.921)
Interactions										
Medium*	72.48	-0.0718	0.747	2.686	3.445	-120.1	0.0242	-1.511	-4.617	-6.124
Tax Group (θ^M)										
	(197.6)	(0.0573)	(2.786)	(9.220)	(9.674)	(196.5)	(0.0517)	(3.747)	(10.93)	(9.300)
High* Tax Group (θ^H)	140.5	-0.0379	1.890	6.756	7.622	92.25	0.0771	2.024	6.073	6.283
	(303.4)	(0.0503)	(4.316)	(14.08)	(13.39)	(258.4)	(0.0485)	(4.792)	(14.44)	(10.08)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear Combination Tests										
$\theta^L + \theta^M$	-139.60	-0.016	-1.66	-6.014	-13.93*	-	-0.053	-8.21***	-	-
	(162.98)	(0.041)	(2.29)	(7.582)	(7.94)	453.42***	(0.035)	23.96***	(7.88)	23.38***
$\theta^L + \theta^H$	-71.55	0.017	-0.524	-1.944	-9.75	-241.09	-0.00	-4.67	-13.27	-10.98
	(280.80)	(0.031)	(3.998)	(13.009)	(12.11)	(217.59)	(0.03)	(4.01)	(12.27)	(7.54)
Observations	15,426	14,205	15,426	15,426	15,426	16,191	15,177	16,191	16,191	16,191

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

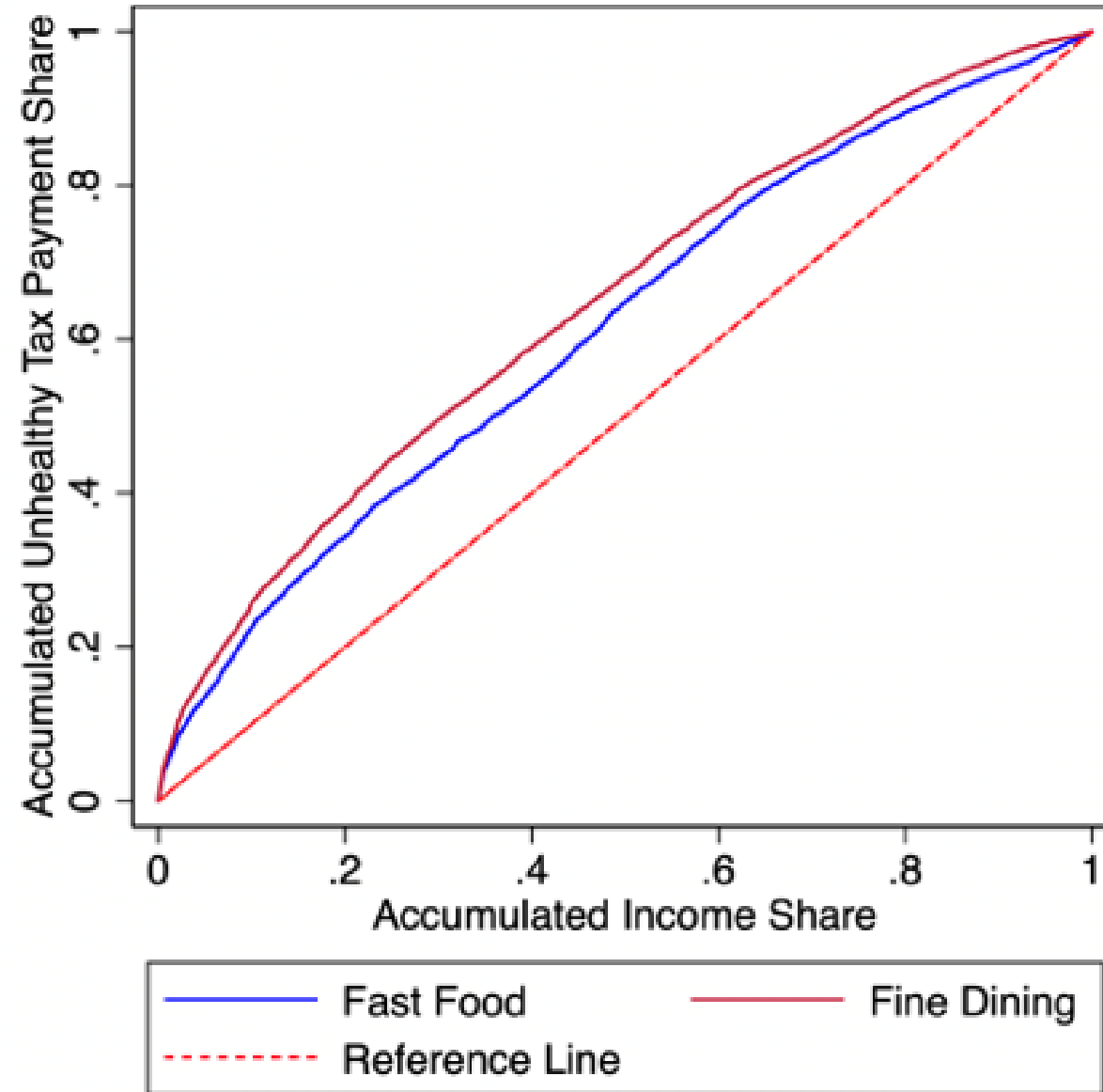


Figure 6. Tax payment share