

Inflation and minimum-wage growth erode the nutritional gains from Mexico's sugar-sweetened beverage tax

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Abstract

A fixed tax on sugar-sweetened beverages (SSBs) loses its effect in two ways: inflation wears down the price increase it imposes, and income growth makes SSBs more affordable. I ask how much of Mexico's one-peso-per-liter tax, enacted in 2014, survives these two effects. I estimate a censored demand system on seven household expenditure surveys from 2012 to 2024. I use its price and income elasticities, along with the tax rate, soft-drink prices, and incomes, to calculate an erosion index that equals 100 in 2014. By 2024, the tax keeps 73 percent of its 2014 effect on SSB consumption in the poorest income tercile and 84 percent in the richest. The price effect is nearly identical across terciles; the gap comes from the income effect, because spending grew fastest and the income elasticity is highest among poor households. A minimum-wage household keeps only 56 percent, and income growth accounts for two-thirds of the points lost. The 2026 reform raises the existing SSB tax from 1.57 to 3.08 pesos per liter, above the 2.65 pesos that restore the 2014 effect for that household. Nevertheless, the margin lasts about four years of real minimum-wage growth at the 2014–2024 pace. A specific health tax holds its effect only if its rate follows both the price of the taxed good and income.

Keywords: sugar-sweetened beverages; soda tax; tax indexation; minimum wage; censored demand systems; Mexico

JEL: H22, H23, I18, D12, J38

1 Introduction

Mexico legislated its sugar-sweetened beverages (SSBs) tax against one of the world’s heaviest burdens of obesity and type 2 diabetes. The SSB tax aimed to reduce consumption through the following chain: the tax raises SSB prices, consumers reduce their calorie intake, and consumption of these products falls (Huang 1996). Yet, obesity and type 2 diabetes have kept growing: adult obesity rose from 30.4 percent in 2006 to 36.9 percent in 2022, and three-quarters of Mexican adults remain overweight or obese (Campos-Nonato et al. 2023). The tax’s price effect is well documented. Purchases of taxed drinks fell about 6 percent over the first year and 12 percent by the second year (Colchero et al. 2016, 2017). Prices rose by roughly the tax amount, unevenly across drinks, with carbonated beverages up 0.96 to 1.20 pesos per liter against a one-peso rate and non-carbonated sweetened drinks up only 0.53 to 0.74 pesos (Colchero, Salgado, Unar-Munguía, Molina, et al. 2015; Campos-Vázquez and Medina-Cortina 2019). Little, however, is known about how income growth can disadvantage the SSB tax purpose. From 1990 to 2016, in 79 of 82 countries studied, the real price of soft drinks fell compared to income. This was most pronounced in low- and middle-income countries because incomes increased faster (Blecher et al. 2017). Inflation wears down the price increase it imposes, and, when the taxed good is normal, income growth raises the purchases it is meant to cut. The tax can therefore lose ground on both fronts, and Mexico offers a clean case of both moving together. Its one-peso-per-liter excise, in force since January 2014, is specific rather than ad valorem,¹ so inflation has eroded the sugar reductions it delivers. Since then, the real minimum wage has more than doubled, and, because SSBs are a normal good (Section 4), wage growth at the bottom has worked against the tax. This paper asks how much of the SSB tax’s effect survives inflation and income growth, and for whom, since its implementation in 2014.

Measuring the two erosions takes two steps. First, I estimate how SSB purchases respond to prices and to income. In my derivation, I show that the own-price elasticity scales the price effect and the income elasticity scales the income effect. I use a censored quadratic almost ideal demand system (QUAIDS) (Banks, Blundell, and Lewbel 1997) over a six-good food basket: SSBs, other sugary drinks, bottled water, milk, food at home, and food away from home. I estimate it on seven survey rounds from 2012 to 2024 with the censored maximum-likelihood estimator of Nava and Dong (2022). The censoring retains the many households that report no purchase of some goods: those zeros are corner solutions rather than missing data, and either dropping them or treating them as non-zeros biases the parameters (Dong, Gould, and Kaiser 2004). The quadratic expenditure term lets the income response bend across the distribution. Second, with these elasticities, I build an erosion index, set to 100 in 2014, that measures the tax’s effect on SSB consumption in each wave relative to its 2014 effect.² I split the change into a price effect (the statutory rate relative to soft-drink prices) and an income effect (real income growth scaled by income elasticity). Evaluating the index by income tercile and for a minimum-wage household shows where the tax lost the most

¹The peso rate was frozen through 2017, raised once in 2018 under the federal tax code’s inflation trigger, and indexed annually to the general consumer price index (INPC) from 2020. See Section A in the appendix for the policy background.

²Mexican SSB elasticities have been estimated many times, and they cluster near unit elasticity. A linear-approximate Almost Ideal Demand System (AIDS) on pooled yearly data puts soft drinks at -1.06 and all SSBs at -1.16 (Colchero, Salgado, Unar-Munguía, Hernández-Ávila, et al. 2015). More recently, Nava and Dong (2022) use a censored demand system and find the main elasticity to be much less elastic at -0.95 , and between -0.83 and -0.99 across 2014, 2016, and 2018. The international range is at least as wide. A review of US studies reports a mean of -0.79 across fourteen estimates spanning -0.13 to -3.18 (Andreyeva, Long, and Brownell 2010), and a multi-country meta-analysis finds an average of -1.30 (Cabrera Escobar et al. 2013). A meta-analysis of enacted taxes finds that a 10 percent tax cuts purchases about 10 percent (Teng et al. 2019; Cawley et al. 2019). Like the Mexican work, these studies focus on the own-price elasticity of SSB demand while the income effect remains understudied.

and which effect drove it.

By 2024, the tax keeps 73 percent of its 2014 effect in the poorest tercile, 76 in the middle, and 84 in the richest. The price effect is nearly the same in every tercile, because the own-price elasticity barely differs by income, so inflation eroded the tax’s effect almost equally for rich and poor. The income effect is regressive: real spending rose most in the poorest tercile, where the income elasticity of SSB purchases is highest. As a result, the tax keeps only 56 percent of its 2014 effect for a minimum-wage household, and income growth took two of every three points it lost. The 2026 reform nearly doubles the rate to 3.08 pesos per liter, above the 2.65 pesos that hold the tax’s 2014 effect for a minimum-wage household at 2024 prices and wages. But the reform keeps an updating rule that tracks general inflation and ignores income growth. Its margin lasts about four years of real minimum-wage growth at the 2014–2024 pace.

The most comparable body of literature concerns the taxation of tobacco products. Nargis et al. (2021) calculate the price increase needed to offset income-growth effects, using elasticities from a single equation applied to country-level data. In contrast, most sugar-sweetened beverage (SSB) tax research focuses on the incidence of soda taxes across income levels. Allcott, Lockwood, and Taubinsky (2019) propose an optimal tax rate of 1 to 2.1 cents per ounce and demonstrate that conclusions regarding regressivity depend on whether higher consumption among lower-income households reflects greater internalization or limited financial resources. Dubois, Griffith, and O’Connell (2020) find that the tax is relatively effective among younger populations but has limited impact on the highest sugar consumers, concluding that the tax is unlikely to be strongly regressive. Neither study examines how income changes affect the tax. The present paper addresses this gap and makes three contributions to the SSB tax literature, with only the final contribution specific to Mexico. First, it quantifies both types of erosion for an actual soft drink tax using price and income elasticities derived from a household demand system, demonstrating that indexing the tax to inflation addresses only one form of erosion. Second, it shows that the erosion is regressive and attributable entirely to the income effect, since the price effect is consistent across income groups. Third, it derives the tax rate needed to maintain a constant impact as prices and incomes change, then applies it to evaluate Mexico’s 2026 reform

The remainder is organized as follows. Section 2 describes the survey data. Section 3 sets out the censored demand system that supplies the elasticities and the tax-incidence arithmetic that defines the erosion index. Section 4 reports the elasticity estimates and the Engel curve of the food budget. Section 5 evaluates the index, decomposes it into its price and income effects, and reads it by tercile, state, and household type. Section 6 puts the 2026 reform’s updating rule on the index and prices the shortfall. Section 7 concludes with the recommendations.

2 Data

The analysis draws on two kinds of data: the *Encuesta Nacional de Ingresos y Gastos de los Hogares* (ENIGH), a household expenditure survey that supplies the quantities, prices, and demographics the demand system is estimated on; and three administrative series. The series are the statutory SSB excise rate; the consumer price index (INPC), in its general and soft-drink components, which deflates every peso amount and tracks soft-drink prices; and the minimum wage, which measures income growth at the bottom.

The estimation data are seven waves of Mexico’s national household income–expenditure survey (2012, 2014, 2016, 2018, 2020, 2022, and 2024) (INEGI 2024a). Each wave’s household sample is a

stratified two-stage probability sample of dwellings that is nationally representative.³ Households record every purchase in a seven-day diary, reporting value and quantity for each item code. The estimation sample is every household with positive food-and-beverage spending. The number of observations rises across waves from 8,929 households in 2012 to 90,803 in 2024. Table 1 gives the count per wave, along with other descriptive statistics.

ENIGH was redesigned in 2016. The *nueva serie* integrated the design of the former *Módulo de Condiciones Socioeconómicas* and expanded the sample roughly fourfold. The larger sample shows in Table 1 as the jump from about 19,000 households in 2014 to 70,000 in 2016. The beverage item codes were unchanged from 2012 through 2022 (Table 2), but they changed in the latest available round, 2024; as Table 2 shows, the previous nomenclature maps cleanly onto the new one.

I aggregate the diary’s item codes into six goods: SSBs; other sugary drinks (packaged juices and nectars, *aguas frescas* preparations, drink concentrates and powders, sports and energy drinks); bottled water; milk; food at home, the remaining at-home food and beverage spending in the diary; and food away from home. Section 3.1 explains the choice. Table 2 lists every beverage code entering each good and the waves in which it applies.

³Every population statistic in the paper applies the survey’s expansion factors.

Table 1: Descriptive statistics of the ENIGH estimation sample by wave

	2012	2014	2016	2018	2020	2022	2024
Households	8,929	19,356	69,848	74,198	88,212	89,444	90,803
<i>Budget shares (percent)</i>							
SSB	4.8 (7.0)	5.0 (7.5)	4.8 (7.4)	4.8 (7.5)	5.1 (8.0)	4.9 (7.6)	5.1 (7.6)
Other sugary	1.1 (2.6)	1.0 (2.9)	0.9 (2.6)	0.8 (2.6)	0.8 (2.7)	0.7 (2.3)	0.7 (2.3)
Water	1.5 (3.8)	1.7 (3.9)	1.5 (3.6)	1.5 (3.5)	1.8 (4.3)	1.5 (3.5)	1.7 (3.7)
Milk	4.6 (6.5)	4.7 (6.4)	4.4 (6.3)	4.1 (6.0)	3.9 (6.0)	3.5 (5.4)	3.5 (5.6)
Food at home	66.7 (25.4)	67.6 (24.5)	65.4 (25.3)	64.9 (25.6)	69.2 (24.8)	66.0 (25.6)	63.3 (25.8)
Food away	21.4 (25.3)	20.0 (24.1)	22.9 (25.4)	23.9 (25.8)	19.3 (23.9)	23.4 (25.4)	25.7 (26.3)
<i>Budget</i>							
Weekly budget (pesos)	662 (473)	691 (507)	758 (562)	861 (644)	867 (612)	1,146 (1,083)	1,279 (975)
<i>Demographics</i>							
Age of head (years)	48.6 (15.9)	48.7 (15.6)	49.1 (15.7)	49.8 (15.8)	51.1 (15.8)	51.3 (15.8)	51.7 (15.8)
Household size	3.7 (1.9)	3.8 (1.9)	3.7 (1.8)	3.6 (1.8)	3.6 (1.8)	3.4 (1.8)	3.4 (1.7)
Schooling of head (years)	7.9 (4.7)	8.2 (4.7)	8.4 (4.7)	8.6 (4.7)	8.7 (4.6)	8.9 (4.6)	9.3 (4.6)
Female head (percent)	25.1 (43.4)	25.5 (43.6)	27.7 (44.8)	28.6 (45.2)	29.8 (45.7)	32.3 (46.8)	33.5 (47.2)
<i>Prices (pesos per liter; food goods as index)</i>							
SSB	8.88 (0.25)	10.15 (0.26)	11.12 (0.25)	12.53 (0.26)	13.76 (0.25)	15.89 (0.28)	17.67 (0.28)
Other sugary	9.10 (0.53)	10.38 (0.49)	11.70 (0.49)	13.90 (0.47)	14.71 (0.44)	19.25 (0.47)	22.54 (0.47)
Water	1.26 (0.66)	1.25 (0.72)	1.38 (0.77)	1.57 (0.77)	1.41 (0.73)	1.79 (0.78)	2.13 (0.78)
Milk	12.05 (0.26)	12.55 (0.28)	13.58 (0.28)	15.27 (0.28)	17.06 (0.27)	20.98 (0.27)	24.11 (0.31)
Food at home (index, 2012 = 1)	1.00 (0.04)	1.08 (0.05)	1.17 (0.06)	1.30 (0.05)	1.45 (0.05)	1.84 (0.05)	1.95 (0.07)
Food away (index, 2012 = 1)	1.00 (0.25)	1.15 (0.24)	1.22 (0.22)	1.38 (0.24)	1.67 (0.23)	2.05 (0.23)	2.38 (0.23)

Note: Factor-weighted household-level means, standard deviations in parentheses. Shares are of the food-and-beverage budget; the budget is the weekly food-and-beverage expenditure; the demographics are in natural units. Prices are averages: pesos per liter for the four beverage goods, which share a comparable liter unit; the two food goods have no liter unit, so their rows are the market-level Stone price indexes the system uses, normalized to 2012 = 1.

The food-at-home and food-away goods aggregate about two hundred diary items in mixed units — kilograms of meat, liters of oil, eggs by the piece — so no single unit value exists for the good as it does for the beverages. I therefore price them with a Stone index over the component items: the expenditure-share-weighted mean of the logged item-level unit values in the household’s municipality and wave, with the weights fixed nationally within each wave so that all cross-municipality variation in the index is price variation, not basket composition.⁴ The index level is identified only up to a wave-specific constant; this is harmless, since every system is estimated within its own wave and the tax shocks land on the beverage goods, which are priced in pesos per liter. Table 1 reports the two food-good indexes normalized to 2012 = 1.

Table 2: ENIGH item codes entering each beverage good

Good	ENIGH code	Item description	Waves
SSB	A220	Cola and flavored sodas	2012–2022
	012601	Cola sodas	2024
	012602	Sodas, other flavors	2024
	012603	Diet (light) sodas	2024
Other sugary	A217	Prepared fruit waters and fresh juices	2012–2022
	A218	Packaged juices and nectars	2012–2022
	A219	Drink concentrates and powders	2012–2022
	A221	Energy drinks	2012–2022
	012100	Packaged fruit and vegetable juices	2024
	012604	Carbonated juices	2024
	012901	Natural <i>aguas frescas</i>	2024
	012903	Sports and isotonic drinks	2024
	012904	Energy drinks	2024
	012905	Drink concentrates and powders	2024
Bottled water	A215	Bottled still water	2012–2022
	A216	Mineral, tonic, or demineralized water	2012–2022
	012501	Bottled still water	2024
	012502	Unflavored mineral water	2024
Milk	A075	Pasteurized cow’s milk	2012–2022
	011411	Fresh whole milk	2024
	011412	Raw (unpasteurized) milk	2024
	011420	Low-fat milk	2024
	011432	Powdered milk	2024

Note: Descriptions are my translations of the official INEGI expenditure catalogs (2012–2022 catalog and the ENIGH 2024 *nueva serie* catalog); the exact Spanish entries are quoted in the replication materials. The 2024 classifier separates diet sodas (012603, under one percent of at-home soda spending), but the earlier catalogs do not. I keep diet sodas inside the SSB aggregate in every wave, 2024 included, so that the good has the same definition in all seven waves. Diet sodas were untaxed until the 2026 reform added a lower tier for drinks with non-caloric sweeteners. Future studies that do not compare against waves before 2024 should treat them as a separate good.

⁴ $\ln P_g(m, t) = \sum_{c \in g} \omega_c(t) \ln p_c(m, t)$, with $p_c(m, t)$ the median unit value of item c among its buyers in municipality m and wave t (falling back to the state, then national, median where buyers are few) and $\omega_c(t)$ the national expenditure share of item c within good g in wave t .

Table 3 reports the statutory *Impuesto Especial sobre Producción y Servicios* (IEPS) rate on flavored beverages. The rate is read from the *Diario Oficial de la Federación*: one peso per liter from January 2014, held nominal through 2017; 1.17 pesos from 2018 under the inflation-updating trigger of the Federal Fiscal Code; and updated annually on the INPC from 2020, reaching 1.57 pesos per liter in 2024 ([Diario Oficial de la Federación 2023](#)) and 3.08 pesos under the 2026 reform. The INPC is the general index, at July values, and defines the rate path that annual indexation from 2014 would have produced.

Table 3: The administrative series by wave: statutory rate, price index, and minimum wage

Wave	IEPS rate (pesos/L)	INPC, general	Minimum wage (pesos/day)	Real minimum wage (2014 = 1)
2012	—	78.9	—	—
2014	1.0000	84.9	67.29	1.00
2016	1.0000	89.6	73.04	1.03
2018	1.1700	99.9	88.36	1.12
2020	1.2616	107.4	123.22	1.45
2022	1.3996	122.9	172.87	1.77
2024	1.5737	136.0	248.93	2.31

Note: The IEPS rate is the statutory specific rate on flavored beverages, in pesos per liter (Table A.1 gives the instrument behind each change; no tax before January 2014). The price index is INEGI’s general INPC at July anchors. The minimum wage is the general daily rate set by the *Comisión Nacional de los Salarios Mínimos* (CONASAMI); the real index deflates it by the general INPC and normalizes it to 2014 = 1.

3 Methodology

3.1 Demand-system estimation

The demand system is the second stage of a two-stage budget. In the first stage a household splits its total outlay between food and everything else; in the second it allocates the food-and-beverage budget across goods. The six goods of Section 2 follow from that structure. SSBs are the taxed good. Other sugary drinks, bottled water, and milk are their nearest substitutes, so each enters on its own and the system returns the cross-price responses among them. Food at home and food away from home take the rest of the budget, which makes the system complete over food and beverages. Completeness is what carries income growth into SSB purchases: a rise in income moves the food budget through the first stage (Equation 9) and SSB purchases through the expenditure elasticity of the second.

Write w_{ih} for household h ’s budget share of good i among the $m = 6$ goods, $\ln p_{jh}$ for its logged prices, $\ln x_h$ for its logged food-and-beverage expenditure, and $\mathbf{z}_h$ for its demographics. The latent share is $w_{ih}^* = \bar{w}_{ih} + \varepsilon_{ih}$, with $\varepsilon_{ih} \sim N(\mathbf{0}, \Sigma)$ a random taste shock and $\bar{w}_{ih}$ the systematic part, which takes the QUAIDS form ([Banks, Blundell, and Lewbel 1997](#)):

$$\bar{w}_{ih} = \alpha_i + \sum_{j=1}^m \gamma_{ij} \ln p_{jh} + (\beta_i + \theta'_i \mathbf{z}_h) (\ln x_h - \ln a(\mathbf{p}_h)) + \frac{\lambda_i}{b(\mathbf{p}_h)} (\ln x_h - \ln a(\mathbf{p}_h))^2, \quad (1)$$

with α_i the constant of equation i , γ_{ij} the price responses, β_i the expenditure response, θ_i its demographic shifters, and λ_i the quadratic expenditure term; $\mathbf{z}_h$ holds the head's age, sex, and schooling, and the household's size; $\ln a(\mathbf{p}_h)$ is the translog price index and $b(\mathbf{p}_h)$ the price aggregator.⁵

A reported share of zero is a corner solution — the household optimally buys none of the good and spreads the budget over the goods it does buy — so observed shares still sum to one. The estimator addresses this censoring with a truncate-and-renormalize mapping introduced for share systems by Wales and Woodland (1983) and implemented in the AIDS by Dong, Gould, and Kaiser (2004):⁶ negative latent shares are set to zero and the row is renormalized onto the simplex. With household h 's goods partitioned into the purchased set $B_h = \{i : w_{ih} > 0\}$ and the censored set $C_h = \{i : w_{ih} = 0\}$, the household's contribution to the Wales–Woodland likelihood integrates the latent density over the censored goods' latent shares, on the event that they are non-positive:

$$\ell_h = \log \int_{\mathbf{w}_{C_h}^* \leq 0} \psi_h^{k_h-1} f(\mathbf{e}_h(\mathbf{w}_{C_h}^*); \Sigma) d\mathbf{w}_{C_h}^*, \quad (2)$$

with k_h the number of goods household h buys, $\psi_h = 1 - \sum_{i \in C_h} w_{ih}^*$ the sum of the positive latent shares, the divisor of the renormalization, and $\mathbf{e}_h$ the residual vector implied by the observed shares once the censored latent shares are fixed, $w_{ih}^* = \psi_h w_{ih}$ for $i \in B_h$. The factor $\psi_h^{k_h-1}$ is the Jacobian of the change of variables from the latent shares to the observed ones, which lie on a $(k_h - 1)$ -dimensional simplex; it is unity at $k_h = 1$ and $k_h = m$. Completing the square in $\mathbf{w}_{C_h}^*$ turns the integral into a constant times a truncated moment of a multivariate normal.

In this analysis, prices are quality-corrected unit values. The diary's expenditure-to-quantity ratios are purged of household quality and measurement components by a within-municipality decomposition. In the tradition of Cox and Wohlgenant (1986) and Deaton (1988), I closely follow Capacci and Mazzocchi (2011) in estimating prices in a prior stage rather than jointly with the demand system. Total food-and-beverage expenditure is chosen alongside the shares (LaFrance 1993; Dhar, Chavas, and Gould 2003), so I replace it in the share equations with its prediction from an auxiliary regression on household income and state of residence.

The elasticities are properties of the estimated system, censoring included. With $E[w_i]$ the expected *observed* share (the mean of the latent system pushed through the mapping described above), the Marshallian price and expenditure elasticities are evaluated at a point in the data $(\bar{\mathbf{p}}, \bar{x}, \bar{\mathbf{z}})$. The quality correction identifies the system's price *variation*; the point at which the system is read is the price households actually face, so $\bar{\mathbf{p}}$ is the mean of the observed unit values for the four beverage goods and the mean of the price indexes for the two food goods. Since $\bar{q}_i = E[w_i] \bar{x} / \bar{p}_i$, the Marshallian price elasticity is $\eta_{ij} = \partial \ln E[w_i] / \partial \ln p_j - \delta_{ij}$ and the expenditure elasticity is $\eta_i = \partial \ln E[w_i] / \partial \ln x + 1$, both read at $(\bar{\mathbf{p}}, \bar{x}, \bar{\mathbf{z}})$.

$E[w_i]$ is the expectation, over the taste shocks, of a share that has been truncated and renormalized, so its derivatives are not an expression in the parameters alone. Dong, Gould, and Kaiser (2004) and Nava and Dong (2022) obtain them numerically: raise one price, or the budget, by one

⁵ $\ln a(\mathbf{p}_h) = \sum_i \alpha_i \ln p_{ih} + \frac{1}{2} \sum_{i,j} \gamma_{ij} \ln p_{ih} \ln p_{jh}$ and $b(\mathbf{p}_h) = \prod_i p_{ih}^{\beta_i}$. Setting every $\lambda_i = 0$ returns the AIDS (Deaton and Muellbauer 1980), a restriction rejected in every wave (the largest $|z|$ among the λ_i runs from 10.4 to 66.3 across waves; Section D). I impose adding-up, homogeneity, and Slutsky symmetry structurally: $\sum_i \alpha_i = 1$, $\sum_i \beta_i = \sum_i \lambda_i = \sum_i \theta_i = \mathbf{0}$, $\sum_i \gamma_{ij} = 0$, and $\gamma_{ij} = \gamma_{ji}$. Adding-up fixes the m -th equation, so the shock vector and Σ are $(m-1)$ -dimensional.

⁶Nava and Dong (2022) extended this estimator to the quadratic AIDS.

percent, re-simulate $E[w_i]$, and form the elasticity. For this paper I derive them in closed form. Write $\partial_j \bar{w}_i$ and $\partial_x \bar{w}_i$ for the derivatives of the systematic share Equation 1 with respect to $\ln p_j$ and $\ln x$, which are explicit in the parameters, and, for a given draw of the shocks, B for the purchased set and $\psi = \sum_{k \in B} w_k^* \geq 1$ for the sum of the positive latent shares, the divisor of the renormalization. Section B shows that the derivative of the expected observed share is the expectation of a regime-specific combination of the latent derivatives, so that

$$\eta_{ij} = \frac{1}{E[w_i]} E \left[\mathbf{1}\{i \in B\} \frac{\partial_j \bar{w}_i - w_i \sum_{k \in B} \partial_j \bar{w}_k}{\psi} \right] - \delta_{ij}, \quad (3)$$

$$\eta_i = \frac{1}{E[w_i]} E \left[\mathbf{1}\{i \in B\} \frac{\partial_x \bar{w}_i - w_i \sum_{k \in B} \partial_x \bar{w}_k}{\psi} \right] + 1, \quad (4)$$

with δ_{ij} the Kronecker delta and $\mathbf{1}\{\cdot\}$ the indicator. The expectation over the shocks is the only integral left, and it is taken on the same common random draws that give $E[w_i]$: one pass over the draws returns the expected shares and every derivative, with no perturbation and no step size, and the numerical scheme converges to Equation 3 and Equation 4 as its step shrinks.⁷ Parameter standard errors come from the outer-product-of-gradients estimate of the information matrix and are reported, with p -values, in Section D. Elasticity standard errors are estimated with the delta method (Section B).

3.2 Tax incidence estimation

The estimand is the tax's incidence on the quantity the health policy targets and how much of that incidence the statute lost to price inflation and income growth. That quantity is the liters of taxed beverages a household buys, and I track it with one total differential. Waves are indexed by t , with $t = 0$ the reference wave, 2014. Taking logs of good i 's demand $\bar{q}_i(\mathbf{p}, x)$ and differentiating both sides,

$$d \ln \bar{q}_{it} = \sum_{j=1}^m \eta_{ijt} d \ln p_{jt} + \eta_{it} d \ln x_t, \quad (5)$$

with η_{ijt} and η_{it} the elasticities of Equation 3 and Equation 4 evaluated on wave t .

The excise is specific: T_{jt} pesos per liter on the taxed goods $j \in \mathcal{T}$, and the shelf price moves from p_{jt}^0 to $p_{jt}^0 + \kappa_j T_{jt}$, with κ_j the pass-through rate — the number of pesos by which the shelf price rises per peso of tax.

The proportional price change the tax delivers is therefore

$$\tau_{jt} = \frac{(p_{jt}^0 + \kappa_j T_{jt}) - p_{jt}^0}{p_{jt}^0} = \frac{\kappa_j T_{jt}}{p_{jt}^0}, \quad j \in \mathcal{T}, \quad \tau_{jt} = 0 \text{ otherwise}, \quad (6)$$

⁷The Hicksian elasticities follow from the Slutsky equation, $\eta_{ij}^h = \eta_{ij} + \eta_i E[w_j]$.

the specific tax acting as an ad valorem rate of τ_{jt} on the price households face, its *effective rate*. κ enters Equation 6 multiplicatively and cancels from the retention factor of Equation 8, so the erosion index below is invariant to it.⁸

Next, setting $d \ln p_{jt} = \tau_{jt}$ in Equation 5 with the food budget held fixed gives the tax's incidence on the quantity of good i as

$$\Delta \ln \bar{q}_{it}^\tau = \sum_{j \in \mathcal{J}} \eta_{ijt} \tau_{jt}. \quad (7)$$

Inflation erodes this effective rate. Write $\nu_{jt} = T_{jt}/T_{j0}$ for the nominal rate relative to 2014 and $\pi_{jt} = p_{jt}^0/p_{j0}^0$ for the good's own price relative to 2014; then

$$\tau_{jt} = \tau_{j0} \rho_{jt}, \quad \rho_{jt} = \frac{\nu_{jt}}{\pi_{jt}}, \quad (8)$$

and ρ_{jt} is the *retention factor*: the share of its 2014 effective rate the tax still carries in wave t , one at $t = 0$, with $1 - \rho_{jt}$ the share inflation has taken.⁹ A rate path is a path for ν_{jt} and hence for ρ_{jt} . The *statutory* path is the enacted schedule; the *frozen* path holds $\nu_{jt} = 1$, so $\rho_{jt} = 1/\pi_{jt}$; the *CPI-smooth* path updates the peso by the general consumer price index every year from 2014; and the *benchmark* path indexes it to the taxed good's own price, $\nu_{jt} = \pi_{jt}$, so $\rho_{jt} = 1$ throughout. Section 5 and Section 6 read the statutory path, the one the law took; Section A sets all four side by side.¹⁰

The income side runs through the last term of Equation 5. What moves there is disposable income — the minimum-wage increases of Section 6, say — and the system is conditional on the food-and-beverage budget x , so that change must first be carried into the budget. Total outlay y is the survey's counterpart to disposable income, and the factor-weighted Engel curve that carries one into the other, estimated wave by wave, is

$$\ln x_h = a_t + b_t \ln y_h + c_t (\ln y_h)^2 + \mathbf{z}'_h \delta_t, \quad g_t(y_h) = \frac{d \ln x_h}{d \ln y_h} = b_t + 2c_t \ln y_h. \quad (9)$$

A curve linear in logs would impose one budget elasticity on every household, but the fraction of a marginal peso that reaches food falls as households grow richer, so $g_t(y_h)$ has to vary with position in the outlay distribution. Real income growth since 2014 then reaches good i in two steps: it raises the food budget by $g_t \Delta \ln y_t$ and, through the income term of Equation 5, purchases of good i by

⁸The quasi-experimental record puts κ near one for sodas and well below it for the other taxed drinks. Carbonated sweetened beverage prices rose 0.96 to 1.20 pesos per liter against the one-peso rate, while non-carbonated sweetened drinks passed through only 0.53 to 0.74 pesos (Colchero, Salgado, Unar-Munguía, Molina, et al. 2015); supermarket scanner data give 1.12 pesos per liter for sodas against 0.25 for juices (Campos-Vázquez and Medina-Cortina 2019).

⁹ π_{jt} is INEGI's official INPC *refrescos envasados* sub-index throughout the study, so the retention factor and everything built on it read the tax against the official price series. The survey's own quality-corrected unit values, on which the demand systems are estimated, erode a little more slowly; Section A reports the tax's effective rate on both series and on the raw unit values households paid, and the three agree on sign, order, and permanence.

¹⁰Substituting Equation 8 into Equation 7, the incidence in wave t is $\sum_{j \in \mathcal{J}} \eta_{ijt} \tau_{j0} \rho_{jt}$, and its change since 2014 has two sources: the inflation erosion at 2014 behavior and the drift of the price response across waves. Adding and subtracting $\eta_{ij0} \rho_{jt}$ gives $\eta_{ijt} \rho_{jt} - \eta_{ij0} = \eta_{ij0}(\rho_{jt} - 1) + (\eta_{ijt} - \eta_{ij0}) \rho_{jt}$, exactly, since $\rho_{j0} = 1$; the first term is the erosion, the second the drift.

$\eta_{it} g_t \Delta \ln y_t$. Write $\omega_t = y_t/y_0$ for the real income index, one in 2014, so that $\ln \omega_t = \Delta \ln y_t$ by construction.

Three indexes, all one in 2014, thus drive the tax’s real effect on a taxed good $i \in \mathcal{T}$: the nominal rate ν_{it} , which raises it; the taxed good’s own price π_{it} , which erodes it; and real income ω_t , which erodes it by enlarging the base it acts on. Weighting each by the elasticity through which it acts — the own-price elasticity of Equation 3 on the retention factor $\rho_{it} = \nu_{it}/\pi_{it}$ of Equation 8, and the expenditure elasticity of Equation 4 times the budget elasticity g_t of Equation 9 on real income — gives the *erosion index*,

$$\mathcal{J}_{it} = 100 \left(\frac{\nu_{it}}{\pi_{it}} \right)^{|\eta_{iit}|} \omega_t^{-\eta_{it} g_t}, \quad \ln \mathcal{J}_{it} = |\eta_{iit}| (\ln \nu_{it} - \ln \pi_{it}) - \eta_{it} g_t \ln \omega_t, \quad (10)$$

100 in 2014 by construction, its first factor the *price effect* (price-side erosion) and its second the *income effect* (income-side dilution).

Setting $\mathcal{J}_{it} = 100$ — no erosion — and solving Equation 10 for the rate gives the level that would hold the 2014 effect,

$$T_{it}^* = T_{i0} \pi_{it} \omega_t^{\eta_{it} g_t / |\eta_{iit}|}, \quad (11)$$

the 2014 rate carried forward twice: by the taxed good’s own price, which repairs the price side, and by a real-income top-up whose exponent is the ratio of the income to the own-price elasticity, 0.45 for SSBs in 2024.¹¹ For SSBs that rate was one peso per liter, so T_{it}^* in pesos also reads as the factor by which the rate would have had to grow.

4 Results

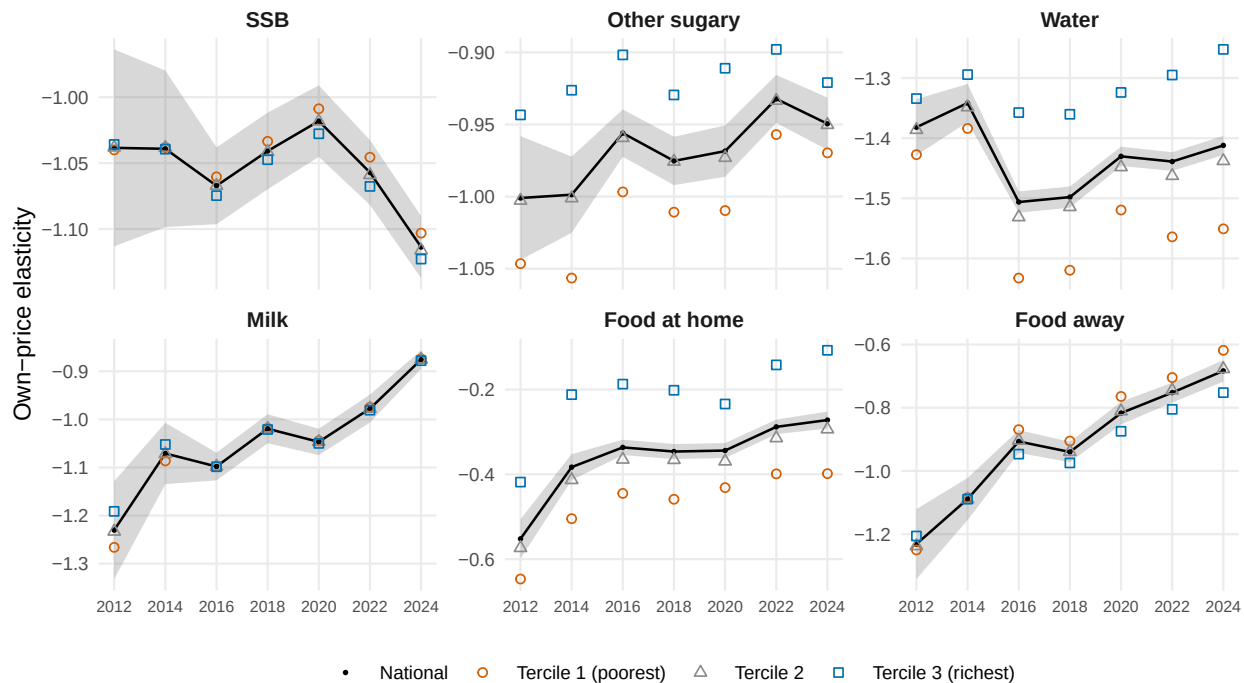
This section reports the two estimations the incidence analysis runs on: Section 4.1 reports the demand elasticities of Section 3.1, and Section 4.2 the Engel curve of Equation 9, which carries a change in disposable income into the food budget. Point estimates of the parameters are tabulated in Section D, and the full elasticity matrices in Section C.

4.1 Elasticity estimates

Figure 1 plots the six own-price elasticities from 2012 to 2024. Figure 2 plots the six expenditure elasticities with respect to total household outlay — the within-food elasticity of Equation 4 carried through the Engel curve of Equation 9. Figure C.1, in the appendix, plots the thirty cross-price ones. The national series are evaluated on each wave’s full sample. The tercile markers evaluate the same fitted system on the wave’s income-tercile subsamples. Bands throughout are 95 percent confidence intervals from the national full-sample estimation.

¹¹Given the elasticities, Equation 10 and Equation 11 follow the log-linear rule that Nargis et al. (2021) apply to tobacco taxes. Reading their price as the retention factor, $\ln P = \ln \rho_{it}$, their income as $\ln Y = \ln \omega_t$, and their price and income elasticities as $\alpha_1 = \eta_{iit}$ and $\alpha_2 = \eta_{it} g_t$, Equation 10 is $\ln(\mathcal{J}_{it}/100) = -(\alpha_1 \ln P + \alpha_2 \ln Y)$, the negative of their consumption response. Setting $\mathcal{J}_{it} = 100$ is their no-change target, $C_d = 0$, and their required price rise, $P\% = (C_d\% - Y\% \alpha_2)/\alpha_1$, becomes $\ln \rho_{it}^* = \ln \omega_t \eta_{it} g_t / |\eta_{iit}|$, the log of Equation 11.

Figure 1: Own-price elasticities, 2012–2024: national series with 95 percent confidence bands, and the system evaluated by income tercile

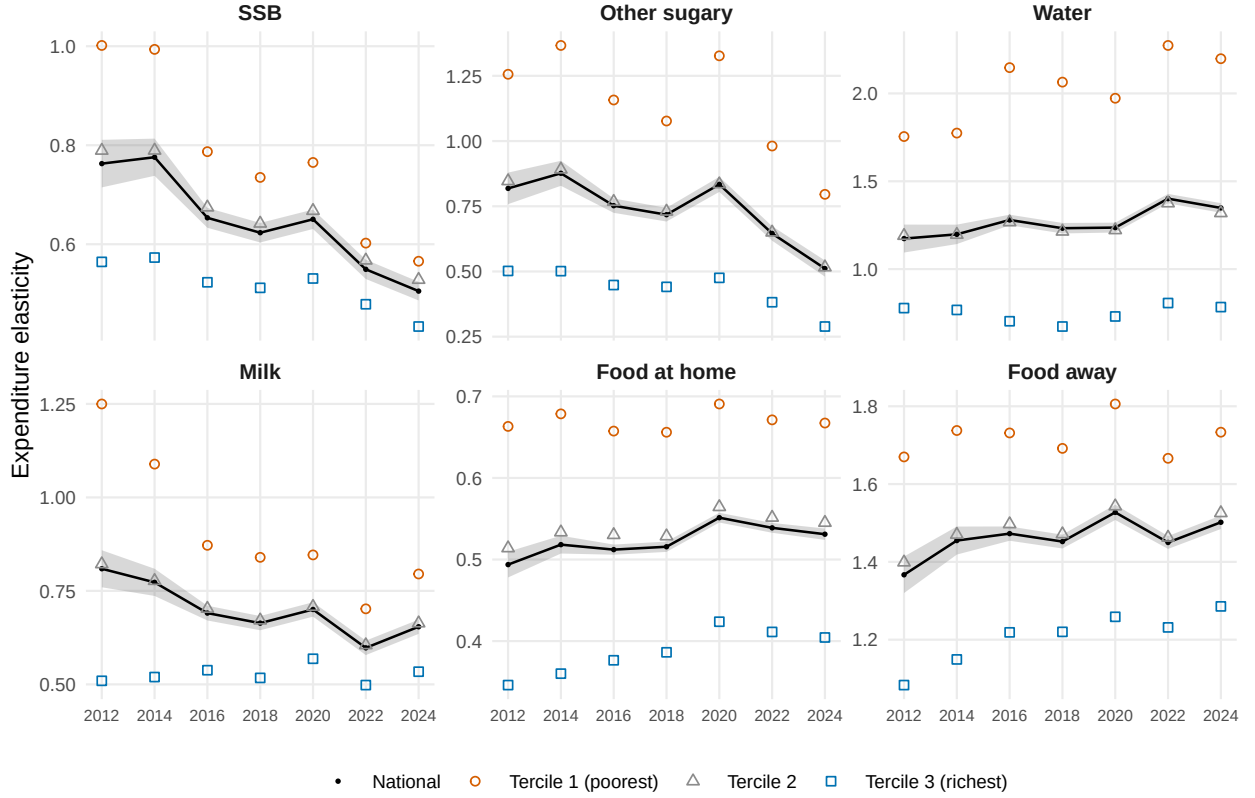


Note: Marshallian own-price elasticities of the censored six-good QUAIDS. Each wave is estimated on its own national sample and evaluated at that wave's mean observed prices (Equation 3). The hollow markers re-evaluate the same fitted system on the wave's income-tercile subsamples, so a marker inside the grey band lies within the national 95 percent interval. Panels carry their own vertical scale.

Price responsiveness for the taxed good does not vary with household income in these data, so the tax removes the same proportion of consumption at the bottom of the income distribution as at the top, and any difference in its distributional effect comes from the budget elasticity. The SSB point estimate is below -1 in every wave, and 2024 is the most responsive of the seven. The own-price elasticity is -1.038 $[-1.113, -0.964]$ in 2012 and -1.114 $[-1.137, -1.090]$ in 2024; its interval lies entirely below that of 2020, -1.018 $[-1.045, -0.991]$, the least responsive. Every interval excludes zero. Those of 2012, 2014, and 2020 contain -1 ; the other four reject unit elasticity from the elastic side. Across income terciles the price response is nearly identical: evaluating the 2024 parameters on each tercile gives -1.103 in the poorest tercile, -1.116 in the middle, and -1.123 in the richest. This holds throughout: each of the SSB tercile points falls inside its wave's national interval.

In 2024 the other five goods run from food at home, the least responsive at -0.272 $[-0.292, -0.252]$, through food away from home at -0.683 $[-0.717, -0.649]$, milk at -0.876 $[-0.895, -0.856]$, and other sugary drinks at -0.949 $[-0.968, -0.931]$, to water, the most responsive at -1.412 $[-1.428, -1.396]$. Only the SSB and water intervals lie below -1 . The tercile evaluations separate for most of these goods. In 2024 water runs -1.551 , -1.438 , and -1.252 from the poorest tercile to the richest, other sugary drinks -0.970 , -0.950 , and -0.921 , and food at home -0.398 , -0.294 , and -0.107 , the poorest tercile the most responsive in each; milk is flat at -0.874 , -0.875 , and -0.878 , and food away from home runs the other way at -0.618 , -0.677 , and -0.752 .

Figure 2: Expenditure elasticities with respect to total household outlay, 2012–2024: national series with 95 percent confidence bands, and the system evaluated by income tercile



Note: Expenditure elasticities of the censored six-good QUAIDS with respect to total household outlay: the within-food-budget elasticity of Equation 4, each wave estimated on its own national sample and evaluated at that wave’s mean observed budgets, multiplied by the budget elasticity g_t of Equation 9. The national series uses the sample-weighted mean of g_t implied by Table 4 and scales its band by the same factor, so g_t is treated as fixed; the hollow markers use each tercile’s own within-food elasticity and its own g_t . A marker inside the grey band therefore lies within the national 95 percent interval. Panels carry their own vertical scale.

In contrast, budget elasticities depend on income, suggesting that the relationship between income growth and consumption is dependent on the income distribution. In 2024, food away from home is 1.502 [1.484, 1.519] and bottled water 1.348 [1.321, 1.376], the only two national expenditure elasticities above one in any wave, while other sugary drinks are 0.511 [0.480, 0.542], milk 0.654 [0.635, 0.673], food at home 0.531 [0.524, 0.538], and SSBs 0.505 [0.486, 0.524], the lowest of the six. SSBs reach that point from 0.763 [0.715, 0.811] in 2012, 0.653 [0.633, 0.673] in 2016, and 0.549 [0.530, 0.569] in 2022. The poorest tercile stood at unit elasticity in 2012, 1.002, and has been below it since 2014; the richest has not reached 0.6 in any wave. The distance between the two narrowed over the decade, from 0.437 in 2012 to 0.123 in 2022 and 0.132 in 2024, because the fall was steepest at the bottom.

Within the food budget, before scaling by g_t (Section C), the SSB elasticity falls from 1.096 [1.027, 1.165] in 2012 to 0.662 [0.637, 0.687] in 2024, its interval lying entirely below one from 2016 on, and by 2024 it is the smallest of the six, below other sugary drinks at 0.670 [0.629, 0.711], food at home at 0.696 [0.687, 0.705], and milk at 0.857 [0.832, 0.882]. Food away from home and bottled water rank first and second in every wave: no water interval falls below 1.55, and food away from home runs from 1.94 to 2.05. Other sugary drinks fall from third to last of the five other goods by

2024. Both they and milk drop below unit elasticity by the end of the period, the first interval lying entirely below one in 2022 for other sugary drinks and in 2016 for milk. Food at home is the most stable series in the system, between 0.695 [0.687, 0.704] and 0.742 [0.734, 0.750] in every wave.

These estimates sit at the elastic end of the Mexican literature reviewed in Section 1. The pooled AIDS soft-drink elasticity of -1.06 (Colchero, Salgado, Unar-Munguía, Hernández-Ávila, et al. 2015) falls inside five of the seven wave intervals and the homogeneous double-log -1.08 of Fuentes Castro and Zamudio Carrillo (2014) inside four, while the censored -0.95 of Nava and Dong (2022) lies above every upper bound. The comparisons are across different good definitions, samples, functional forms, and price constructions, and are recorded for placement rather than as tests.

4.2 Engel curve estimates

The demand system is conditional on the food-and-beverage budget, so the income effect of Equation 10 reaches it only through the Engel curve of Equation 9. Table 4 reports that regression, refit on each wave’s own sample.

Table 4: Engel curve of Equation 9, by wave

	2012	2014	2016	2018	2020	2022	2024
$\ln y_h$	2.275*** (0.149)	2.341*** (0.095)	2.165*** (0.060)	2.043*** (0.065)	2.369*** (0.061)	2.119*** (0.091)	2.077*** (0.061)
$(\ln y_h)^2$	-0.0806*** (0.0079)	-0.0817*** (0.0048)	-0.0719*** (0.0031)	-0.0649*** (0.0033)	-0.0810*** (0.0031)	-0.0664*** (0.0045)	-0.0625*** (0.0029)
$\ln$ age of head	0.040* (0.021)	0.061*** (0.012)	0.039*** (0.008)	0.053*** (0.009)	0.034*** (0.007)	0.052*** (0.007)	0.051*** (0.007)
1 / household size	-0.315*** (0.037)	-0.185*** (0.020)	-0.219*** (0.012)	-0.191*** (0.012)	-0.258*** (0.011)	-0.182*** (0.009)	-0.151*** (0.010)
Years of schooling	-0.0079*** (0.0020)	-0.0057*** (0.0011)	-0.0080*** (0.0007)	-0.0062*** (0.0007)	-0.0077*** (0.0006)	-0.0074*** (0.0005)	-0.0088*** (0.0006)
Female head	-0.071*** (0.016)	-0.037*** (0.009)	-0.044*** (0.005)	-0.043*** (0.005)	-0.042*** (0.005)	-0.033*** (0.004)	-0.030*** (0.004)
Constant	-8.200*** (0.723)	-8.881*** (0.475)	-7.970*** (0.298)	-7.490*** (0.331)	-9.001*** (0.304)	-8.003*** (0.462)	-8.014*** (0.317)
Observations	8,929	19,356	69,848	74,198	88,212	89,444	90,803
R^2	0.656	0.691	0.656	0.663	0.624	0.632	0.621

Note: Weighted least squares of Equation 9, the log food-and-beverage budget on log total outlay, its square, and the demographics of Section 3.1, refit wave by wave on the estimation sample with the survey expansion factors as weights. Heteroskedasticity-robust (HC1) standard errors in parentheses; the expansion factors are sampling weights rather than precision weights, so model-based errors would understate these by roughly half. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

The coefficient c_t is negative in every wave, so the curve is concave and g_t falls with income; with g_t below one from the tenth to the ninetieth percentile in every wave, food’s budget share falls as households grow richer (Engel’s law). g_t also stays well above zero throughout: in 2024 a one percent rise in total outlay raises the food budget by 0.89 percent at the tenth percentile and 0.66 percent at the ninetieth, so food spending rises with income everywhere in the sample, only at a diminishing rate. The gap between the two ends is what makes the income effect regressive in

Section 5: the same proportional income gain moves the food budget, and with it SSB purchases, further for poor households than for rich ones.

5 The erosion analysis

5.1 Inputs to the erosion index

This section evaluates the erosion index of Equation 10 on the statutory rate, wave by wave, through each wave’s own demand system. Most inputs have already been presented: the elasticities of Section 4.1 (Section C gives the full matrices), the Engel curve of Table 4, and the rate, price, and minimum-wage series of Table 3. Table 5 collects what Equation 10 consumes, wave by wave, in the notation of Section 3.2.

Table 5: Inputs to the erosion index, by wave

Input	2014	2016	2018	2020	2022	2024
Nominal rate index, ν_t	1.000	1.000	1.170	1.262	1.400	1.574
SSB price index, π_t	1.000	1.064	1.206	1.351	1.562	1.814
Retention, $\rho_t = \nu_t/\pi_t$	1.000	0.940	0.970	0.934	0.896	0.867
Own-price elasticity, $ \eta_{iit} $	1.039	1.067	1.041	1.018	1.057	1.114
Income elasticity, η_{it}	1.058	0.887	0.847	0.875	0.734	0.662
Budget elasticity, g_t	0.733	0.737	0.736	0.743	0.748	0.763
Real minimum wage, $\ln \omega_t$	0.000	0.029	0.110	0.370	0.573	0.837
Real spending, tercile 1, $\ln \omega_t$	0.000	0.060	0.075	0.027	0.179	0.267
Real spending, tercile 2, $\ln \omega_t$	0.000	0.055	0.081	-0.020	0.126	0.214
Real spending, tercile 3, $\ln \omega_t$	0.000	-0.014	-0.003	-0.178	-0.019	0.047

Note: Indexes are 2014 = 1, so their logs are 0 in 2014. The rate index is the IEPS rate of Table A.1; the price index is INEGI’s INPC *refrescos envasados* at July anchors; the minimum wage is CONASAMI’s general daily rate deflated by the general INPC, the income index of Section 6. Real spending is the tercile’s survey mean of total expenditure deflated by the general INPC, the income index of Figure 3. Elasticities and g_t are the national values of the wave’s own system (Section 4).

5.2 Tax erosion 2014–2024: Inflation and spending growth

Figure 3 evaluates Equation 10 on the statutory rate with the inputs of Table 5 separately for the three terciles. Each bar is one step of the index in a wave, the price effect in dark grey and the income effect in orange. The row along the bottom is the level the tax reached after each wave. The erosion is uneven across the terciles. By 2024 the tax kept 73 percent of its 2014 effect in the poorest tercile, 76 in the middle, and 84 in the richest.

Figure 3: Erosion index of the statutory rate by income tercile, 2014–2024: the price and income steps of each wave (2014 = 100)



Note: Equation 10 for SSBs on the statutory rate, evaluated with each tercile’s own-price and income elasticities and g_t . The elasticities are evaluated on income terciles (Section 4.1), real spending on spending terciles. The income index is the tercile’s real total spending in ENIGH relative to 2014, the survey mean deflated by the general INPC, not the minimum wage. Each wave adds two steps to the running level: the price effect, $\Delta[\eta_{iit}(\ln \nu_{it} - \ln \pi_{it})]$, and the income effect, $-\Delta[\eta_{it} g_t \ln \omega_t]$; the price step is applied first. Each bar is the change in the level its step produces, in index points, so the bars add up to the index exactly; the number on each bar is that change and the bold row along the bottom is the level after each wave.

The price effect is all but identical across terciles in every wave. The grey bar of Figure 3 reads -6.3 , -6.4 , and -6.4 in 2016; $+3.1$, $+3.2$, and $+3.3$ in 2018; -3.4 , -3.4 , and -3.7 in 2020; -4.1 , -4.3 , and -4.7 in 2022; and -3.3 , -3.4 , and -3.7 in 2024. The panels cannot differ by more than a few tenths because the price effect multiplies the own-price elasticity, which Section 4 showed sits within about two hundredths across the distribution, and the retention factor of Equation 8, which is common to all households because every household faces the same statutory rate and the same price of soft drinks. The sign pattern of the first two waves is explained by the text of the initial decree. The 2013 decree fixed the rate at one peso per liter and left it there until cumulative inflation crossed the ten percent threshold of the federal tax code, so between 2014 and 2016 the rate did not move while the price of soft drinks rose 6 percent. When the threshold fired in 2018, the statutory rate rose to 1.17 pesos and the bar turned positive. The 2019 reform then replaced the threshold with annual updating by the general INPC from 2020, and from that wave on the bar is negative in every panel because the general INPC lagged soft-drink inflation in every interval. The price effect records what the statute did, identically for rich and poor, and cannot be the source of the gap between the panels.

The erosion is therefore not regressive on the price effect, which barely moves across terciles, but on the income effect, where the orange bars of Figure 3 differ across the panels in every wave. Real spending rose 31, 24, and 5 percent between 2014 and 2024, most at the bottom, so the tercile that gained the most income turned the most of that gain into SSB purchases. Figure 2 gives the expenditure elasticity that sets how much.

The sign of the bar says which way spending moved, negative when real spending rose and positive when it fell. In 2016 the bar is -4.3 in the poorest tercile and -3.4 in the middle, where spending

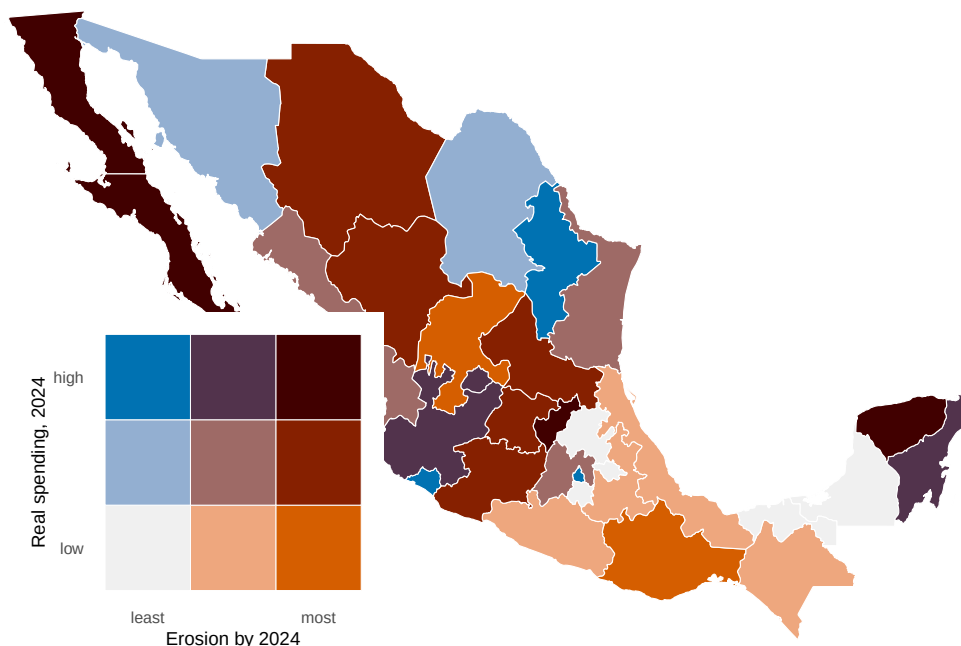
rose about 6 percent in both, and $+0.7$ in the richest, where it fell 1 percent; in 2018 it is small everywhere, -0.7 , -1.4 , and -0.6 , because spending barely moved. The one wave in which all three bars are positive is 2020, the pandemic survey: real spending fell in every tercile, so every tercile's SSB purchases fell with its spending and the index rose, by $+3.1$, $+6.0$, and $+9.1$. The 2022 recovery reversed it. In 2022 real spending rebounded by 16 to 17 percent in all three terciles, and the bars are -7.2 , -7.3 , and -8.0 , the richest tercile's the largest in points only because it falls from the highest level. In 2024, spending rose 9 percent at the bottom against 7 at the top, and the bar is largest in the poorest tercile, -3.3 against -3.2 and -2.5 . The richest tercile's real spending only regained its 2014 level in 2024, so its orange bars nearly cancel and its index, 84, ends closest to 100.

The regressivity is thus entirely an income-side result.

5.3 Erosion across states and household types

The tercile gap of Figure 3 could stand in for something other than income growth: where poorer households live, or who heads them. This subsection checks both. It applies Equation 10 to the 32 states, which face one federal rate and one national soft-drink price but saw very different growth in real spending, and, within each income tercile, to household types defined by the head's sex, age, and schooling.

Figure 4: Erosion index of the statutory rate by state in 2024 against the state's real spending (2014 = 100)

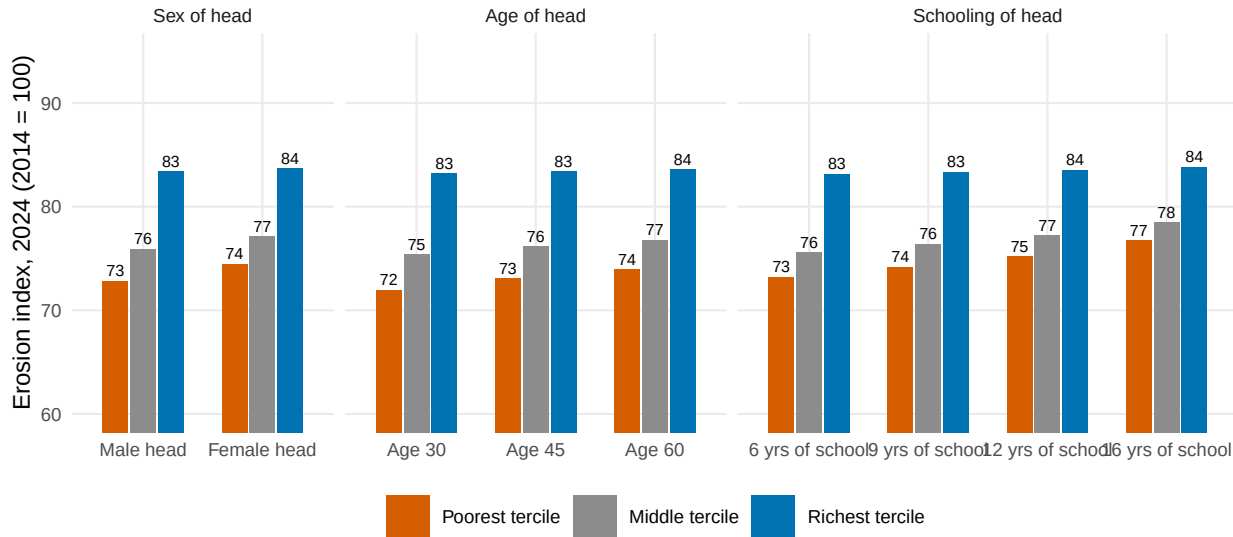


Note: Colors class each state by its tercile of the index (columns of the legend, least to most eroded) and by its tercile of 2024 real spending relative to the national mean (rows). State polygons are Natural Earth admin-1 boundaries.

Figure 4 asks whether the tax eroded most where households are poor or where their spending grew the most. It is the second. The 2024 index runs from 73 in Michoacán to 88 in Campeche, and its correlation with the state's real spending level is -0.06 . What the index follows is spending growth.

Its correlation with the state’s real spending index since 2014 is -0.99, because the own-price and income elasticities vary little across states (ranges of 0.09 and 0.14 in 2024) while real spending growth runs from -6 to 35 percent. The retention factor is the same in every state by construction, and the own-price elasticity nearly so; the income effect is the state’s spending growth times an elasticity that is nearly common, so the tax lost the most ground where real spending rose the most, whichever level it rose from.

Figure 5: Erosion index of the statutory rate in 2024 by income tercile and profile of the household head (2014 = 100)



Note: Each bar uses the tercile’s real spending and g_t of Table 5 and the own-price and income elasticities of each wave’s fitted system evaluated at the tercile’s mean prices and budget, with the head’s sex, age, or schooling set to the value on the axis and the other demographics at the tercile mean. Terciles are the income terciles of the elasticity evaluation of Section 4.1.

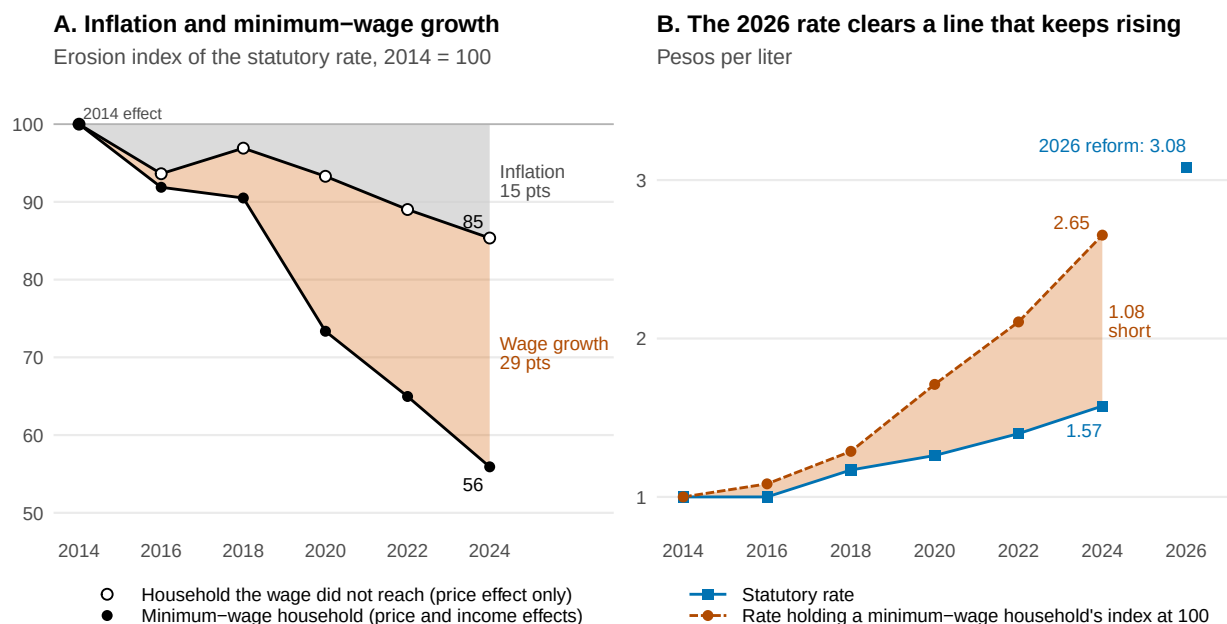
Household type moves the index far less than the tercile does. Holding the head male, the richest tercile ends 10.5 points above the poorest. Within a tercile, relative to a male head, a female head raises the index by +1.6, +1.2, and +0.3 points in the three terciles; a head aged 60 sits +2.0, +1.4, and +0.4 points above one aged 30; and sixteen years of schooling sit +3.5, +2.9, and +0.7 points above six. The head’s demographics move the elasticities of Equation 1 only at the margin; the index follows the tercile’s spending growth and g_t , which every profile in the tercile shares.

Across terciles, states, and household types, the regressivity comes from the income effect. All three face nearly the same price effect, because a specific rate set against a national price takes the same share of every household’s soft-drink spending. What separates them is how much their real spending grew and how much of that growth the income elasticity turned into SSB purchases. Neither geography nor the head’s demographics adds anything that income growth does not already carry, so the tercile gap is not a stand-in for either. A rate indexed to soft-drink prices, even perfectly, would have held the price effect at zero everywhere and left every difference shown here in place, since nothing in the 2014 design responds to what households earn. Section 6 takes up the rule that does.

6 Policy implications of the 2026 reform

Figure 6 reads Equation 10 by minimum-wage exposure. Panel A splits the erosion into its two drivers, inflation and minimum-wage growth. The tax falls short of its 2014 effect in every wave, both for a minimum-wage household and for a household the wage did not reach, but by far more for the first. For a minimum-wage household the index reads 92 in 2016, 73 in 2020, and 56 in 2024. For a household the wage did not reach, it reads 85 in 2024, so the price effect explains about a third of the loss and the income effect two thirds. Panel B prices the gap in pesos per liter. The rate that holds the index at 100 for a minimum-wage household, Equation 11, was 1.08 pesos per liter in 2016 against the statute's 1.00, 1.71 against 1.26 in 2020, and 2.65 against 1.57 in 2024: by the last wave the statute delivered three fifths of the rate the 2014 effect required.

Figure 6: Erosion index of the statutory rate by minimum-wage exposure (A), and the statutory rate against the rate that holds the index at 100 in pesos per liter (B), 2014–2026



Note: Equation 10 for SSBs at the ENIGH waves, 2014 = 100. The rate index is the IEPS rate of Table A.1; the minimum-wage household carries the full income term, the other household none. The two households are reference cases, not bounds: they bracket the three terciles of Figure 3 in 2024, but not in earlier waves, when tercile spending moved differently from the minimum wage. All use INEGI's INPC *refrescos envasados* at July anchors as the price index, CONASAMI's general daily minimum wage deflated by the general INPC as the wage index, and the own-price and income elasticities and g_t of the wave's own system. In panel A the grey band is the price effect, the gap between 100 and the household the wage did not reach, and the orange band the income effect, the gap between the two households. Panel B reads, in pesos per liter, the IEPS rate of Table A.1 and Equation 11 for a minimum-wage household, the 2014 rate of one peso updated by the taxed good's price index and topped up for real-wage growth; the band is the shortfall. The 2026 point is the reform's rate, flagged against the 2024 requirement; the other series end in 2024, the last ENIGH wave. In panel A the bands are named by what drives each effect: inflation of the taxed good's price, and real minimum-wage growth.

The 2026 reform raises the rate to 3.08 pesos per liter and keeps the general-INPC updating rule. The rule itself is not the problem: updating the rate by the INPC carries it forward with the overall cost of the basket households buy. What the rule ignores is income. Nothing in the new text accounts for the income effect, and incomes in Mexico have risen rapidly: the real minimum wage more than doubled between 2014 and 2024, up 131 percent (Table 3), and real spending rose 31

percent in the poorest tercile (Table 5). With a positive income elasticity, part of every peso of that growth became SSB purchases that an INPC-updated rate does not remove. Holding the 2014 effect for a minimum-wage household takes 2.65 pesos per liter in 2024 (Equation 11); the statute's 1.57 is three fifths of that, 1.08 pesos short, and the reform's 3.08, nearly double the statute, clears it by 0.43 pesos. At 2024 prices, wages, and elasticities, 3.08 pesos lifts the index to 118 for a minimum-wage household and to 180 for a household the wage did not reach. The reform thus more than restores the 2014 effect where incomes rose fastest and overcorrects where they stood still. But because its rule is unchanged, the margin is temporary: a further 39 percent rise in the real minimum wage returns a minimum-wage household's index to 100, which at the 2014–2024 pace of real-wage growth takes about four years, and the gap reopens with every increase after that.

7 Concluding remarks

Mexico's one-peso excise on sugar-sweetened beverages is a peso amount per liter, set against two moving quantities, the price of the good it taxes and the income of the households it targets. This paper measures how much ground the tax lost to each. Estimated wave by wave on the full ENIGH samples, the censored six-good demand system finds SSB demand slightly price elastic in every wave and income inelastic in every wave with respect to total spending, with the income response highest at the bottom of the distribution. The price side eroded the tax almost equally in every income tercile in every wave (Figure 3), because own-price elasticities barely differ by income. The divergence across terciles is entirely the income side's doing. Real spending growth, largest at the bottom, cost the poorest tercile the most, so the tax kept 73 percent of its 2014 effect at the bottom and 84 at the top. A reform intended to hold the tax's effect would do three things. First, recover the ground lost since 2014, or gain on it: at 2024 prices and wages that means a level of 2.65 pesos per liter for a minimum-wage household, which the reform's 3.08 clears, so the level is repaired and the 0.43 pesos above it are a real increase rather than a catch-up. Second, keep the rate indexed to prices, but to the price of the good it taxes. Third, index it to income growth as well. The reform's text ignores income growth, which took two of every three points a minimum-wage household lost and which will consume the reform's margin in about four years at the 2014–2024 pace of real minimum-wage growth, and sooner if soft-drink prices keep outrunning the INPC.

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A Policy background

The 2013 decree ([Diario Oficial de la Federación 2013](#)) set a rate of \$1.00 per liter on flavored beverages with added sugar from January 2014, updated per the federal tax code’s threshold rule: no change until cumulative inflation exceeds 10 percent (Código Fiscal de la Federación, art. 17-A). That rule produced a four-year nominal freeze followed by one catch-up. A decree of 9 December 2019 ([Diario Oficial de la Federación 2019a](#)) switched the rate to annual indexation from 2020; the implementing Acuerdo of 24 December set the 2020 rate at \$1.2616 per liter ([Diario Oficial de la Federación 2019b](#)). The reform decree of 7 November 2025 ([Diario Oficial de la Federación 2025a](#)) nearly doubles the caloric-sweetener rate for 2026 and introduces a lower tier for non-caloric sweeteners, while keeping the updating rule ([Diario Oficial de la Federación 2025b](#)). Table A.1 gives the complete history.

Table A.1: The statutory rate on *bebidas saborizadas*, 2014–2026

In force	Rate (MXN/L)	Legal act	Mechanism event
2014–2017	1.00	Decreto DOF 11/12/2013	rate set; CFF 17-A threshold updating (>10% cumulative)
2018–2019	1.17	RMF 2018 (DOF 22/12/2017)	the threshold fires once
2020	1.26	Decreto DOF 09/12/2019; Acuerdo 136/2019 (DOF 24/12/2019)	index reform: annual CPI updating begins
2021–2025	1.30 → 1.65	Acuerdos 138/2020, 173/2021, 176/2022, 177/2023, 180/2024	CPI updating
2026	3.08 / 1.50	Decreto DOF 07/11/2025; Acuerdo 179/2025 (DOF 22/12/2025)	level reform: caloric tier $\times 1.87$; non-caloric tier added; index rule unchanged

Note: Rates are rounded to two decimals; every value is verified against the *Diario Oficial de la Federación* instrument shown (replication materials quote each exact statutory figure). CFF is the Código Fiscal de la Federación (federal tax code); RMF the Resolución Miscelánea Fiscal (annual tax regulations). The 2026 rates are exempt from updating for 2026 only, then re-enter annual CPI indexation.

The record thus contains three regimes: a frozen nominal rate (2014–2019, with one triggered catch-up), a CPI-indexed rate (2020–), and a CPI-indexed rate at a much higher level (2026–). A fourth object the analysis needs was never legislated: a rate that keeps pace with the price of the good it taxes. That object needs no new statute to describe — it is the effective rate of the 2014 peso amount held constant — and it anchors everything that follows.

The natural common scale for comparing these regimes is the peso rate expressed as a share of that year’s SSB price — the tax’s effective ad valorem rate. Four rate paths span the policy space:

- **Statutory** — the staircase of Table A.1: what the law did.

- **CPI-smooth** — the 2014 peso updated by general-CPI inflation every year from the start. The counterfactual the 2020 reform was reaching for.
- **Frozen** — the rate held at one peso: the statute as originally written, never updated.
- **Benchmark** — the rate rising exactly as fast as the SSB price itself, so the effective rate stays at the enacted 2014 level of 9.8 percent. A peso rate indexed to the taxed good’s own price and an ad valorem tax at the same effective rate are the same tax in real terms — an identity, not an approximation. To legislate it, the rate would be indexed to the official soft-drink price index (INPC *refrescos envasados*) instead of the general CPI. The WHO-recommended magnitude, a 20 percent price increase ([World Health Organization 2016](#)), is about twice this rate.

The record reduces to one comparison: the distance between each path and the flat benchmark, not the level of any single path. The statutory effective rate tracks the frozen path through 2019, opening a gap of 0.86 percentage points against the benchmark by 2016, over half of it (0.49 points) the freeze itself. The 2018 catch-up closes part of that gap, and from 2020 the statutory rate climbs in parallel with the CPI-smooth counterfactual, nearly rejoining it by 2024 (rate 1.57 against 1.60 pesos: the threshold rule is a lumpy CPI tracker, and the lumpiness cost little once the freeze ended). Neither path reaches the benchmark. The residual gap does not close over time, because it is the ongoing drift of a CPI-indexed rate on a good whose price outgrows the CPI; a future catch-up in level would not remove it, since it re-opens every year. Every rate quoted here uses the quality-corrected price series the demand systems are estimated on; against the raw unit values households actually paid, the 2024 statutory effective rate reads 9.5 rather than 8.9 percent, and the benchmark is identically an ad valorem at 10.1 percent of the retail price.

The 2024 gap between the statutory tax and the benchmark is 0.92 percentage points of the effective rate. This splits into two causes: slow updating (the freeze and lumpy catch-ups) contributes only 0.16 points — the 2020 reform largely repaired it — while indexing to the general CPI rather than to beverage prices contributes 0.76, and this second component grows over time as beverage prices keep outrunning the CPI. Scaled by the benchmark rate, the CPI-indexation gap is 7.7 percent of the tax per decade under survey prices and 11.7 percent under the official INPC *refrescos envasados* series ([INEGI 2024b](#)), whose beverage prices grew $1.81\times$ against the general CPI’s $1.60\times$; under that official series the 2024 statutory rate reads 8.5 rather than 8.9 percent. The two series bracket the truth and agree on sign, order and permanence. The frozen-peso path, for completeness, ends 4.2 points below benchmark — a 42 percent loss — but that construct stopped being law in 2018.

B Closed-form elasticities of the censored system

This appendix derives Equation 3 and Equation 4 and states the delta-method standard errors. The household index is dropped, and every quantity is read at $(\bar{\mathbf{p}}, \bar{x}, \bar{\mathbf{z}})$.

B.1 Setting

The latent shares are $w_i^* = \bar{w}_i + \varepsilon_i$, $i = 1, \dots, m$, with $\bar{w}_i$ the systematic share of Equation 1, $(\varepsilon_1, \dots, \varepsilon_{m-1})' \sim N(\mathbf{0}, \Sigma)$ and $\varepsilon_m = -\sum_{i < m} \varepsilon_i$, so that $\sum_i w_i^* = 1$. The estimator maps latent to observed shares by

$$B = \{k : w_k^* > 0\}, \quad \psi = \sum_{k \in B} w_k^* = 1 - \sum_{k \notin B} w_k^* \geq 1, \quad w_i = \begin{cases} w_i^*/\psi & i \in B, \\ 0 & i \notin B, \end{cases} \quad (12)$$

and the expected observed share is $E[w_i]$, the expectation over ε .

The derivatives of Equation 1 are explicit. With $a_j(\mathbf{p}) = \partial \ln a(\mathbf{p}) / \partial \ln p_j = \alpha_j + \sum_l \gamma_{jl} \ln p_l$, $\partial \ln b(\mathbf{p}) / \partial \ln p_j = \beta_j$ and $u = \ln x - \ln a(\mathbf{p})$,

$$\partial_x \bar{w}_i = \beta_i + \theta'_i \mathbf{z} + \frac{2\lambda_i}{b(\mathbf{p})} u, \quad \partial_j \bar{w}_i = \gamma_{ij} - a_j(\mathbf{p}) \partial_x \bar{w}_i - \frac{\lambda_i \beta_j}{b(\mathbf{p})} u^2. \quad (13)$$

The adding-up restrictions give $\sum_i \partial_x \bar{w}_i = 0$ and $\sum_i \partial_j \bar{w}_i = 0$ for every j . Without censoring, Equation 13 divided by the share are the elasticity formulas of Banks, Blundell, and Lewbel (1997).

B.2 Derivative of the expected observed share

Proposition. Let v be any one of $\ln p_1, \dots, \ln p_m, \ln x$ and $d_k = \partial \bar{w}_k / \partial v$. Then

$$\frac{\partial E[w_i]}{\partial v} = E \left[\mathbf{1}\{i \in B\} \frac{d_i - w_i \sum_{k \in B} d_k}{\psi} \right]. \quad (14)$$

Proof. Fix ε and regard the observed shares as a function of the latent ones through Equation 12. Since ε has a density, no w_k^* equals zero with probability one, and B is constant in a neighbourhood of $\mathbf{w}^*$. On that neighbourhood $w_i = w_i^*/\psi$, so

$$\frac{\partial w_i}{\partial w_k^*} = \frac{\delta_{ik} \psi - w_i^*}{\psi^2} \quad (i, k \in B), \quad \frac{\partial w_i}{\partial w_k^*} = 0 \quad \text{otherwise.} \quad (15)$$

Every entry is bounded by 2 in absolute value, because $\psi \geq 1$ and $0 < w_i^* \leq \psi$ for $i \in B$. The map Equation 12 is continuous ($w_i \rightarrow 0$ as $w_i^* \downarrow 0$, and $\mathbf{w}$ does not move when a negative w_k^* moves) and piecewise smooth with a bounded gradient, hence Lipschitz. As $\bar{\mathbf{w}}$ is smooth in v , the function $v \mapsto w_i(\bar{\mathbf{w}}(v) + \varepsilon)$ is Lipschitz with a constant that does not depend on ε , so dominated convergence lets the derivative pass under the expectation. On the probability-one set where B is locally constant, the chain rule with $\partial w_k^* / \partial v = d_k$ and Equation 15 gives, for $i \in B$,

$$\frac{\partial w_i}{\partial v} = \sum_{k \in B} \frac{\delta_{ik} \psi - w_i^*}{\psi^2} d_k = \frac{d_i - w_i \sum_{k \in B} d_k}{\psi},$$

and zero for $i \notin B$. Taking expectations yields Equation 14. $\square$

Three consequences. First, by adding-up, $\sum_{k \in B} d_k = -\sum_{k \notin B} d_k$: the second term in Equation 14 is the latent response of the goods not bought, passed on to the goods bought by the renormalization, and the division by ψ rescales the latent response to the observed simplex. Second, when every good is bought, $\psi = 1$ and $\sum_{k \in B} d_k = 0$, so the integrand is d_i ; when only good i is bought, $w_i = 1$ and the integrand is zero. With no censoring, Equation 14 returns $\partial_j \bar{w}_i$ and $\partial_x \bar{w}_i$, and the elasticities reduce to the uncensored QUAIDS formulas. Third, since $\sum_i w_i = 1$ for every draw, the

integrand sums to zero over i draw by draw, so Engel and Cournot aggregation, $\sum_i E[w_i] \eta_i = 1$ and $\sum_i E[w_i] \eta_{ij} = -E[w_j]$, hold exactly for the elasticities built from Equation 14, whatever the number of draws.

B.3 The elasticities and their computation

Since $\bar{q}_i = E[w_i] \bar{x} / \bar{p}_i$, $\eta_{ij} = \partial \ln E[w_i] / \partial \ln p_j - \delta_{ij}$ and $\eta_i = \partial \ln E[w_i] / \partial \ln x + 1$; substituting Equation 13 into Equation 14 gives Equation 3 and Equation 4. Everything inside the expectations is an explicit function of the parameters and the draw. The expectation over ε is the only integral left; for the partially censored regimes it is the mean of a ratio over a truncated normal, with no expression in standard functions, so it is evaluated by simulation. Draw R shock vectors once and hold them fixed. For a given parameter vector, compute $\bar{\mathbf{w}}$, $\partial_j \bar{w}_i$ and $\partial_x \bar{w}_i$ from Equation 1 and Equation 13; for each draw r form $\mathbf{w}_r^*$, B_r , ψ_r and $\mathbf{w}_r$, and accumulate $w_{r,i}$ and the two integrands of Equation 3 and Equation 4 for $i \in B_r$. Dividing by R gives $E[w_i]$, $\partial E[w_i] / \partial \ln p_j$ and $\partial E[w_i] / \partial \ln x$ in one pass over the draws, at the cost of one evaluation of the expected shares. The numerical procedure of Dong, Gould, and Kaiser (2004) and Nava and Dong (2022) needs $m + 1$ further simulations and a step; with common draws its elasticity is a piecewise smooth function of the step and converges to Equation 3 and Equation 4 as the step shrinks, with an error of the first order in the step.

B.4 Standard errors

For fixed draws, the vector $\eta(\vartheta)$ stacking the m^2 price and m expenditure elasticities is a deterministic function of the parameter vector ϑ , so the delta method gives

$$\widehat{\text{Var}}(\hat{\eta}) = \mathbf{G} \hat{\mathbf{V}} \mathbf{G}', \quad \mathbf{G} = \left. \frac{\partial \eta}{\partial \vartheta'} \right|_{\hat{\vartheta}}, \quad (16)$$

with $\hat{\mathbf{V}}$ the outer-product-of-gradients covariance of Section D. I evaluate Equation 16 by simulation: each of 200 draws $\vartheta_b \sim N(\hat{\vartheta}, \hat{\mathbf{V}})$ is run through Equation 3 and Equation 4 on the same shock draws, and the standard deviation of the 200 elasticity points is the reported standard error.

C Elasticity estimates

The tables below give the numbers behind every panel of Figure 1 and Figure C.1, and the within-food expenditure elasticities behind Figure 2: the full Marshallian matrix of the censored six-good system — six price responses and the expenditure response for each good — for each wave, most recent first. Standard errors are in parentheses (Section 3.1).

Figure C.1: Cross-price elasticities, 2012–2024: national series with 95 percent confidence bands, and the system evaluated by income tercile



Note: Marshallian cross-price elasticities of the censored six-good QUAIDS. Each wave is estimated on its own national sample and evaluated at that wave's mean prices with respect to the quantity (first reported good in the label of each panel). The hollow markers re-evaluate the same fitted system on the wave's income-tercile subsamples, so a marker inside the grey band lies within the national 95 percent interval. Panels carry their own vertical scale.

Table C.1: Marshallian elasticities, 2024

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.11 (0.012)	0.03 (0.006)	0.09 (0.005)	0.06 (0.008)	-0.68 (0.026)	0.95 (0.017)	0.66 (0.013)
Other sugary	0.31 (0.017)	-0.95 (0.009)	-0.10 (0.008)	0.29 (0.013)	-0.82 (0.039)	0.61 (0.032)	0.67 (0.021)
Water	0.51 (0.013)	0.14 (0.008)	-1.41 (0.008)	0.05 (0.011)	-1.64 (0.034)	0.58 (0.024)	1.77 (0.018)
Milk	0.12 (0.011)	0.16 (0.007)	0.04 (0.005)	-0.88 (0.010)	-0.74 (0.028)	0.45 (0.020)	0.86 (0.013)
Food home	-0.08 (0.003)	-0.04 (0.002)	-0.01 (0.001)	-0.05 (0.002)	-0.27 (0.010)	-0.25 (0.007)	0.70 (0.005)
Food away	0.19 (0.006)	0.08 (0.004)	0.03 (0.004)	0.08 (0.005)	-1.67 (0.022)	-0.68 (0.017)	1.97 (0.012)

Table C.2: Marshallian elasticities, 2022

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.06 (0.013)	0.07 (0.006)	0.11 (0.005)	0.08 (0.010)	-0.91 (0.027)	0.98 (0.016)	0.73 (0.013)
Other sugary	0.41 (0.016)	-0.93 (0.008)	-0.12 (0.007)	0.36 (0.013)	-1.41 (0.038)	0.83 (0.029)	0.86 (0.019)
Water	0.56 (0.013)	0.11 (0.008)	-1.44 (0.008)	0.09 (0.012)	-1.76 (0.033)	0.56 (0.023)	1.87 (0.018)
Milk	0.13 (0.012)	0.19 (0.007)	0.06 (0.005)	-0.98 (0.015)	-0.84 (0.030)	0.64 (0.019)	0.80 (0.013)
Food home	-0.09 (0.003)	-0.05 (0.001)	-0.01 (0.001)	-0.06 (0.002)	-0.29 (0.009)	-0.22 (0.006)	0.72 (0.004)
Food away	0.21 (0.006)	0.10 (0.004)	0.04 (0.004)	0.13 (0.005)	-1.66 (0.021)	-0.75 (0.016)	1.94 (0.011)

Table C.3: Marshallian elasticities, 2020

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.02 (0.014)	0.06 (0.007)	0.13 (0.005)	0.08 (0.010)	-1.13 (0.029)	1.02 (0.018)	0.87 (0.013)
Other sugary	0.41 (0.019)	-0.97 (0.009)	-0.20 (0.008)	0.30 (0.014)	-1.67 (0.041)	1.01 (0.030)	1.12 (0.020)
Water	0.57 (0.013)	0.02 (0.008)	-1.43 (0.008)	0.09 (0.011)	-1.62 (0.033)	0.70 (0.022)	1.66 (0.019)
Milk	0.14 (0.013)	0.17 (0.007)	0.07 (0.005)	-1.05 (0.014)	-0.85 (0.031)	0.57 (0.019)	0.94 (0.013)
Food home	-0.10 (0.003)	-0.04 (0.002)	-0.01 (0.001)	-0.05 (0.002)	-0.34 (0.009)	-0.20 (0.006)	0.74 (0.004)
Food away	0.29 (0.008)	0.11 (0.005)	0.04 (0.004)	0.14 (0.006)	-1.82 (0.026)	-0.82 (0.018)	2.05 (0.013)

Table C.4: Marshallian elasticities, 2018

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.04 (0.015)	0.05 (0.007)	0.11 (0.005)	0.13 (0.011)	-1.04 (0.028)	0.94 (0.017)	0.85 (0.014)
Other sugary	0.29 (0.017)	-0.98 (0.009)	-0.10 (0.008)	0.30 (0.015)	-1.24 (0.038)	0.74 (0.029)	0.98 (0.018)
Water	0.51 (0.014)	0.13 (0.008)	-1.50 (0.009)	0.08 (0.013)	-1.30 (0.035)	0.40 (0.024)	1.68 (0.021)
Milk	0.20 (0.013)	0.17 (0.007)	0.06 (0.006)	-1.02 (0.015)	-0.93 (0.032)	0.62 (0.018)	0.90 (0.013)
Food home	-0.10 (0.003)	-0.04 (0.002)	0.00 (0.001)	-0.06 (0.003)	-0.35 (0.009)	-0.16 (0.006)	0.70 (0.004)
Food away	0.22 (0.007)	0.07 (0.004)	0.00 (0.004)	0.13 (0.006)	-1.45 (0.022)	-0.94 (0.016)	1.97 (0.012)

Table C.5: Marshallian elasticities, 2016

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.07 (0.015)	0.06 (0.007)	0.09 (0.005)	0.13 (0.011)	-1.11 (0.029)	1.01 (0.018)	0.89 (0.014)
Other sugary	0.30 (0.017)	-0.96 (0.008)	-0.14 (0.008)	0.22 (0.015)	-1.29 (0.036)	0.84 (0.029)	1.02 (0.019)
Water	0.45 (0.014)	0.07 (0.008)	-1.51 (0.009)	0.04 (0.013)	-1.23 (0.034)	0.44 (0.026)	1.74 (0.021)
Milk	0.20 (0.013)	0.13 (0.007)	0.03 (0.006)	-1.10 (0.015)	-0.75 (0.032)	0.54 (0.020)	0.94 (0.014)
Food home	-0.10 (0.003)	-0.04 (0.002)	0.00 (0.002)	-0.04 (0.003)	-0.34 (0.009)	-0.18 (0.007)	0.70 (0.004)
Food away	0.25 (0.007)	0.07 (0.004)	0.00 (0.004)	0.11 (0.006)	-1.53 (0.023)	-0.91 (0.018)	2.00 (0.013)

Table C.6: Marshallian elasticities, 2014

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.04 (0.030)	0.12 (0.012)	0.13 (0.011)	0.13 (0.023)	-1.30 (0.055)	0.91 (0.034)	1.06 (0.026)
Other sugary	0.41 (0.031)	-1.00 (0.013)	-0.11 (0.015)	0.20 (0.027)	-1.76 (0.066)	1.07 (0.052)	1.19 (0.033)
Water	0.38 (0.025)	0.02 (0.012)	-1.34 (0.016)	0.02 (0.022)	-1.25 (0.063)	0.55 (0.044)	1.63 (0.038)
Milk	0.23 (0.025)	0.17 (0.011)	0.04 (0.011)	-1.07 (0.033)	-1.06 (0.060)	0.64 (0.035)	1.05 (0.025)
Food home	-0.09 (0.005)	-0.05 (0.003)	-0.02 (0.003)	-0.04 (0.005)	-0.38 (0.016)	-0.12 (0.011)	0.71 (0.008)
Food away	0.22 (0.014)	0.09 (0.007)	0.07 (0.008)	0.13 (0.013)	-1.40 (0.043)	-1.09 (0.034)	1.98 (0.025)

Table C.7: Marshallian elasticities, 2012

	SSB	Oth. sugary	Water	Milk	Food home	Food away	Expend.
SSB	-1.04 (0.038)	0.07 (0.018)	0.10 (0.017)	-0.04 (0.037)	-0.89 (0.083)	0.70 (0.047)	1.10 (0.035)
Other sugary	0.29 (0.045)	-1.00 (0.022)	-0.06 (0.021)	0.09 (0.044)	-1.01 (0.099)	0.52 (0.076)	1.18 (0.044)
Water	0.33 (0.040)	0.05 (0.020)	-1.38 (0.024)	-0.16 (0.038)	-0.76 (0.099)	0.23 (0.076)	1.69 (0.058)
Milk	0.10 (0.037)	0.15 (0.018)	-0.05 (0.018)	-1.23 (0.052)	-0.84 (0.091)	0.70 (0.052)	1.16 (0.036)
Food home	-0.05 (0.007)	-0.03 (0.004)	-0.00 (0.005)	-0.02 (0.009)	-0.55 (0.024)	-0.06 (0.018)	0.71 (0.012)
Food away	0.13 (0.019)	0.03 (0.012)	0.03 (0.013)	0.16 (0.020)	-1.08 (0.062)	-1.23 (0.056)	1.96 (0.034)

Note: Rows are goods; columns the price (or the food-and-beverage expenditure, last column) the good responds to; each good's standard error sits beneath its estimate. Each wave's system is estimated on that wave's national sample and evaluated at its mean observed prices (Section 3.1).

D Parameter estimates

Each wave's censored QUAIDS is a 65-parameter maximum-likelihood problem. With six goods the food-away-from-home equation is dropped and recovered from adding-up, leaving five estimated equations; the free parameters are the intercepts α_i , the expenditure slopes β_i and quadratic terms λ_i (five each), the fifteen free price terms γ_{ij} of the symmetric 6×6 price matrix (homogeneity and adding-up fill the rest), four demographic shifters θ per equation — log age of the head, inverse household size, the head's schooling in years, and a female-head indicator — and the fifteen elements of the upper-triangular factor R of the error covariance $\Sigma = R'R$. Every wave's likelihood converges (BHHH, gradient tolerance 10^{-4}). The seven tables that follow report all point estimates with their asymptotic standard errors (from the outer-product-of-gradients estimate of the information matrix), z -statistics, and p -values, most recent wave first, each table carrying its fit statistics at the foot.

Table D.1: Parameter estimates, 2024

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.2185	0.0069	31.86	<0.001	θ_{SSB} : ln age	-0.0157	0.0009	-18.35	<0.001
α_{OthSug}	-0.1276	0.0056	-22.95	<0.001	θ_{SSB} : 1/size	-0.0324	0.0013	-24.70	<0.001
α_{Water}	-0.5183	0.0027	-195.44	<0.001	θ_{SSB} : educ yrs	-0.0021	0.0001	-26.19	<0.001
α_{Milk}	0.0573	0.0065	8.76	<0.001	θ_{SSB} : female head	-0.0099	0.0007	-14.46	<0.001
α_{FoodH}	1.4527	0.0192	75.71	<0.001	θ_{OthSug} : ln age	-0.0135	0.0006	-22.23	<0.001
β_{SSB}	-0.0021	0.0050	-0.41	0.679	θ_{OthSug} : 1/size	-0.0084	0.0011	-7.97	<0.001
β_{OthSug}	0.1065	0.0037	28.48	<0.001	θ_{OthSug} : educ yrs	0.0002	0.0001	2.66	0.008
β_{Water}	0.2735	0.0023	119.54	<0.001	θ_{OthSug} : female head	0.0010	0.0005	1.80	0.072
β_{Milk}	-0.0149	0.0048	-3.08	0.002	θ_{Water} : ln age	-0.0041	0.0007	-6.10	<0.001
β_{FoodH}	-0.6318	0.0135	-46.63	<0.001	θ_{Water} : 1/size	0.0238	0.0010	24.86	<0.001
$\gamma_{SSB,SSB}$	-0.0281	0.0020	-13.85	<0.001	θ_{Water} : educ yrs	-0.0000	0.0001	-0.19	0.851
$\gamma_{SSB,OthSug}$	0.0106	0.0009	11.25	<0.001	θ_{Water} : female head	0.0041	0.0005	8.79	<0.001
$\gamma_{OthSug,OthSug}$	-0.0022	0.0007	-3.38	<0.001	θ_{Milk} : ln age	0.0049	0.0008	6.33	<0.001
$\gamma_{SSB,Water}$	0.0370	0.0012	32.04	<0.001	θ_{Milk} : 1/size	-0.0189	0.0012	-16.34	<0.001
$\gamma_{OthSug,Water}$	-0.0145	0.0009	-16.80	<0.001	θ_{Milk} : educ yrs	0.0002	0.0001	2.66	0.008
$\gamma_{Water,Water}$	-0.0847	0.0008	-112.31	<0.001	θ_{Milk} : female head	0.0055	0.0006	9.70	<0.001
$\gamma_{SSB,Milk}$	0.0040	0.0012	3.26	0.001	θ_{FoodH} : ln age	0.1192	0.0023	51.90	<0.001
$\gamma_{OthSug,Milk}$	0.0141	0.0008	17.90	<0.001	θ_{FoodH} : 1/size	-0.2215	0.0037	-60.38	<0.001
$\gamma_{Water,Milk}$	0.0055	0.0011	5.10	<0.001	θ_{FoodH} : educ yrs	-0.0052	0.0002	-24.78	<0.001
$\gamma_{Milk,Milk}$	0.0096	0.0010	9.72	<0.001	θ_{FoodH} : female head	0.0081	0.0018	4.40	<0.001
$\gamma_{SSB,FoodH}$	-0.1536	0.0036	-42.81	<0.001	R_{11}	0.1386	0.0003	459.16	<0.001
$\gamma_{OthSug,FoodH}$	-0.0227	0.0024	-9.42	<0.001	R_{12}	0.0027	0.0005	5.75	<0.001
$\gamma_{Water,FoodH}$	0.0805	0.0031	25.61	<0.001	R_{22}	0.0888	0.0004	237.93	<0.001
$\gamma_{Milk,FoodH}$	-0.0651	0.0030	-21.91	<0.001	R_{13}	-0.0071	0.0004	-16.94	<0.001
$\gamma_{FoodH,FoodH}$	0.4097	0.0124	33.13	<0.001	R_{23}	0.0038	0.0005	7.01	<0.001
λ_{SSB}	0.0056	0.0006	9.32	<0.001	R_{33}	0.0900	0.0003	320.88	<0.001
λ_{OthSug}	-0.0094	0.0004	-21.09	<0.001	R_{14}	-0.0091	0.0005	-19.85	<0.001
λ_{Water}	-0.0289	0.0004	-66.30	<0.001	R_{24}	0.0015	0.0006	2.49	0.013
λ_{Milk}	-0.0028	0.0005	-5.12	<0.001	R_{34}	0.0027	0.0005	5.08	<0.001
λ_{FoodH}	-0.0054	0.0015	-3.59	<0.001	R_{44}	0.1145	0.0003	389.78	<0.001
					R_{15}	-0.0881	0.0016	-53.84	<0.001
					R_{25}	-0.0461	0.0021	-21.46	<0.001
					R_{35}	-0.0327	0.0018	-18.31	<0.001
					R_{45}	-0.0186	0.0016	-11.30	<0.001
					R_{55}	0.3824	0.0012	321.72	<0.001
Households	90,803				Log-likelihood	-21,059			
AIC	42,248				BIC	42,860			
Iterations	28				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); z = estimate/SE and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. AIC = $2 \cdot 65 - 2 \log L$, BIC = $65 \log n - 2 \log L$.

Table D.2: Parameter estimates, 2022

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.2339	0.0078	30.10	<0.001	$\theta_{\text{SSB}}: \ln \text{ age}$	-0.0181	0.0009	-20.58	<0.001
α_{OthSug}	-0.1389	0.0052	-26.85	<0.001	$\theta_{\text{SSB}}: 1/\text{size}$	-0.0200	0.0013	-15.81	<0.001
α_{Water}	-0.4878	0.0030	-161.32	<0.001	$\theta_{\text{SSB}}: \text{educ yrs}$	-0.0021	0.0001	-26.76	<0.001
α_{Milk}	0.0885	0.0066	13.41	<0.001	$\theta_{\text{SSB}}: \text{female head}$	-0.0091	0.0007	-13.75	<0.001
α_{FoodH}	1.2671	0.0197	64.38	<0.001	$\theta_{\text{OthSug}}: \ln \text{ age}$	-0.0135	0.0006	-23.23	<0.001
β_{SSB}	0.0024	0.0058	0.41	0.684	$\theta_{\text{OthSug}}: 1/\text{size}$	-0.0037	0.0010	-3.92	<0.001
β_{OthSug}	0.1189	0.0037	32.54	<0.001	$\theta_{\text{OthSug}}: \text{educ yrs}$	0.0001	0.0001	2.41	0.016
β_{Water}	0.2566	0.0024	105.49	<0.001	$\theta_{\text{OthSug}}: \text{female head}$	0.0019	0.0005	4.03	<0.001
β_{Milk}	-0.0311	0.0049	-6.38	<0.001	$\theta_{\text{Water}}: \ln \text{ age}$	-0.0044	0.0006	-7.01	<0.001
β_{FoodH}	-0.5573	0.0145	-38.44	<0.001	$\theta_{\text{Water}}: 1/\text{size}$	0.0240	0.0009	26.75	<0.001
$\gamma_{\text{SSB,SSB}}$	-0.0178	0.0020	-9.02	<0.001	$\theta_{\text{Water}}: \text{educ yrs}$	-0.0001	0.0000	-2.12	0.034
$\gamma_{\text{SSB,OthSug}}$	0.0158	0.0009	17.30	<0.001	$\theta_{\text{Water}}: \text{female head}$	0.0037	0.0004	8.20	<0.001
$\gamma_{\text{OthSug,OthSug}}$	-0.0036	0.0007	-5.52	<0.001	$\theta_{\text{Milk}}: \ln \text{ age}$	0.0039	0.0008	5.01	<0.001
$\gamma_{\text{SSB,Water}}$	0.0353	0.0012	28.48	<0.001	$\theta_{\text{Milk}}: 1/\text{size}$	-0.0195	0.0011	-17.62	<0.001
$\gamma_{\text{OthSug,Water}}$	-0.0177	0.0007	-23.94	<0.001	$\theta_{\text{Milk}}: \text{educ yrs}$	0.0003	0.0001	5.31	<0.001
$\gamma_{\text{Water,Water}}$	-0.0758	0.0008	-90.28	<0.001	$\theta_{\text{Milk}}: \text{female head}$	0.0073	0.0006	13.18	<0.001
$\gamma_{\text{SSB,Milk}}$	0.0042	0.0013	3.25	0.001	$\theta_{\text{FoodH}}: \ln \text{ age}$	0.1170	0.0023	51.92	<0.001
$\gamma_{\text{OthSug,Milk}}$	0.0175	0.0008	22.66	<0.001	$\theta_{\text{FoodH}}: 1/\text{size}$	-0.2499	0.0037	-66.66	<0.001
$\gamma_{\text{Water,Milk}}$	0.0106	0.0010	10.36	<0.001	$\theta_{\text{FoodH}}: \text{educ yrs}$	-0.0056	0.0002	-27.00	<0.001
$\gamma_{\text{Milk,Milk}}$	-0.0012	0.0015	-0.81	0.419	$\theta_{\text{FoodH}}: \text{female head}$	0.0065	0.0019	3.50	<0.001
$\gamma_{\text{SSB,FoodH}}$	-0.1601	0.0033	-47.94	<0.001	R_{11}	0.1310	0.0003	471.21	<0.001
$\gamma_{\text{OthSug,FoodH}}$	-0.0356	0.0022	-16.03	<0.001	R_{12}	0.0015	0.0004	3.49	<0.001
$\gamma_{\text{Water,FoodH}}$	0.0604	0.0030	20.14	<0.001	R_{22}	0.0796	0.0003	248.68	<0.001
$\gamma_{\text{Milk,FoodH}}$	-0.0824	0.0029	-28.89	<0.001	R_{13}	-0.0069	0.0004	-17.77	<0.001
$\gamma_{\text{FoodH,FoodH}}$	0.4670	0.0109	42.93	<0.001	R_{23}	0.0036	0.0005	7.76	<0.001
λ_{SSB}	0.0069	0.0007	10.17	<0.001	R_{33}	0.0817	0.0003	317.27	<0.001
λ_{OthSug}	-0.0096	0.0004	-23.37	<0.001	R_{14}	-0.0088	0.0004	-20.78	<0.001
λ_{Water}	-0.0256	0.0004	-65.30	<0.001	R_{24}	0.0015	0.0006	2.64	0.008
λ_{Milk}	-0.0010	0.0005	-1.83	0.067	R_{34}	0.0015	0.0005	2.98	0.003
λ_{FoodH}	-0.0095	0.0016	-5.96	<0.001	R_{44}	0.1079	0.0003	396.82	<0.001
					R_{15}	-0.1017	0.0016	-63.55	<0.001
					R_{25}	-0.0540	0.0020	-26.47	<0.001
					R_{35}	-0.0306	0.0017	-17.58	<0.001
					R_{45}	-0.0195	0.0016	-12.35	<0.001
					R_{55}	0.3687	0.0011	329.72	<0.001
Households	89,444				Log-likelihood	-9,057			
AIC	18,245				BIC	18,856			
Iterations	29				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); $z = \text{estimate}/\text{SE}$ and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. $\text{AIC} = 2 \cdot 65 - 2 \log L$, $\text{BIC} = 65 \log n - 2 \log L$.

Table D.3: Parameter estimates, 2020

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.1941	0.0094	20.64	<0.001	θ_{SSB} : ln age	-0.0252	0.0011	-22.91	<0.001
α_{OthSug}	-0.2315	0.0059	-39.49	<0.001	θ_{SSB} : 1/size	-0.0106	0.0016	-6.56	<0.001
α_{Water}	-0.4819	0.0035	-135.95	<0.001	θ_{SSB} : educ yrs	-0.0026	0.0001	-26.59	<0.001
α_{Milk}	0.0672	0.0073	9.19	<0.001	θ_{SSB} : female head	-0.0122	0.0009	-14.10	<0.001
α_{FoodH}	1.4644	0.0229	63.83	<0.001	θ_{OthSug} : ln age	-0.0162	0.0007	-22.22	<0.001
β_{SSB}	0.0539	0.0072	7.50	<0.001	θ_{OthSug} : 1/size	0.0046	0.0011	4.03	<0.001
β_{OthSug}	0.1715	0.0042	40.56	<0.001	θ_{OthSug} : educ yrs	-0.0000	0.0001	-0.27	0.788
β_{Water}	0.2485	0.0033	76.19	<0.001	θ_{OthSug} : female head	0.0015	0.0006	2.50	0.012
β_{Milk}	-0.0344	0.0058	-5.96	<0.001	θ_{Water} : ln age	-0.0046	0.0008	-5.56	<0.001
β_{FoodH}	-0.7617	0.0177	-43.15	<0.001	θ_{Water} : 1/size	0.0209	0.0012	16.90	<0.001
$\gamma_{SSB,SSB}$	-0.0117	0.0024	-4.85	<0.001	θ_{Water} : educ yrs	0.0002	0.0001	2.62	0.009
$\gamma_{SSB,OthSug}$	0.0148	0.0012	12.71	<0.001	θ_{Water} : female head	0.0046	0.0006	7.36	<0.001
$\gamma_{OthSug,OthSug}$	-0.0125	0.0009	-13.37	<0.001	θ_{Milk} : ln age	0.0079	0.0010	8.23	<0.001
$\gamma_{SSB,Water}$	0.0333	0.0014	23.61	<0.001	θ_{Milk} : 1/size	-0.0233	0.0014	-16.28	<0.001
$\gamma_{OthSug,Water}$	-0.0293	0.0008	-36.62	<0.001	θ_{Milk} : educ yrs	0.0006	0.0001	7.68	<0.001
$\gamma_{Water,Water}$	-0.0746	0.0010	-74.98	<0.001	θ_{Milk} : female head	0.0060	0.0007	8.40	<0.001
$\gamma_{SSB,Milk}$	0.0062	0.0016	3.95	<0.001	θ_{FoodH} : ln age	0.1497	0.0029	52.27	<0.001
$\gamma_{OthSug,Milk}$	0.0173	0.0010	17.57	<0.001	θ_{FoodH} : 1/size	-0.3077	0.0046	-66.28	<0.001
$\gamma_{Water,Milk}$	0.0103	0.0011	9.29	<0.001	θ_{FoodH} : educ yrs	-0.0036	0.0002	-14.43	<0.001
$\gamma_{Milk,Milk}$	-0.0078	0.0016	-4.85	<0.001	θ_{FoodH} : female head	0.0126	0.0023	5.53	<0.001
$\gamma_{SSB,FoodH}$	-0.1858	0.0045	-41.75	<0.001	R_{11}	0.1520	0.0003	438.34	<0.001
$\gamma_{OthSug,FoodH}$	-0.0136	0.0030	-4.54	<0.001	R_{12}	0.0033	0.0005	7.07	<0.001
$\gamma_{Water,FoodH}$	0.0716	0.0034	20.99	<0.001	R_{22}	0.0874	0.0004	246.68	<0.001
$\gamma_{Milk,FoodH}$	-0.0749	0.0036	-20.80	<0.001	R_{13}	-0.0101	0.0005	-20.69	<0.001
$\gamma_{FoodH,FoodH}$	0.4309	0.0149	28.84	<0.001	R_{23}	0.0018	0.0006	3.02	0.002
λ_{SSB}	0.0053	0.0008	6.61	<0.001	R_{33}	0.1019	0.0003	314.33	<0.001
λ_{OthSug}	-0.0142	0.0005	-27.41	<0.001	R_{14}	-0.0095	0.0005	-18.16	<0.001
λ_{Water}	-0.0261	0.0005	-52.80	<0.001	R_{24}	0.0021	0.0007	3.20	0.001
λ_{Milk}	-0.0017	0.0006	-2.76	0.006	R_{34}	-0.0009	0.0006	-1.55	0.120
λ_{FoodH}	-0.0049	0.0019	-2.61	0.009	R_{44}	0.1254	0.0003	386.36	<0.001
					R_{15}	-0.1355	0.0018	-73.91	<0.001
					R_{25}	-0.0710	0.0022	-32.41	<0.001
					R_{35}	-0.0430	0.0019	-22.43	<0.001
					R_{45}	-0.0403	0.0017	-23.07	<0.001
					R_{55}	0.3879	0.0013	310.03	<0.001
Households	88,212				Log-likelihood	-31,584			
AIC	63,298				BIC	63,908			
Iterations	32				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); z = estimate/SE and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. $AIC = 2 \cdot 65 - 2 \log L$, $BIC = 65 \log n - 2 \log L$.

Table D.4: Parameter estimates, 2018

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.1722	0.0083	20.83	<0.001	$\theta_{\text{SSB}}: \ln \text{ age}$	-0.0169	0.0009	-18.38	<0.001
α_{OthSug}	-0.1337	0.0048	-27.64	<0.001	$\theta_{\text{SSB}}: 1/\text{size}$	-0.0128	0.0014	-9.20	<0.001
α_{Water}	-0.4722	0.0042	-112.99	<0.001	$\theta_{\text{SSB}}: \text{educ yrs}$	-0.0020	0.0001	-23.91	<0.001
α_{Milk}	0.0487	0.0072	6.75	<0.001	$\theta_{\text{SSB}}: \text{female head}$	-0.0100	0.0007	-13.61	<0.001
α_{FoodH}	1.4167	0.0203	69.73	<0.001	$\theta_{\text{OthSug}}: \ln \text{ age}$	-0.0160	0.0006	-28.54	<0.001
β_{SSB}	0.0350	0.0059	5.93	<0.001	$\theta_{\text{OthSug}}: 1/\text{size}$	-0.0057	0.0009	-6.15	<0.001
β_{OthSug}	0.1291	0.0031	41.00	<0.001	$\theta_{\text{OthSug}}: \text{educ yrs}$	-0.0000	0.0001	-0.38	0.706
β_{Water}	0.2362	0.0030	80.00	<0.001	$\theta_{\text{OthSug}}: \text{female head}$	0.0018	0.0005	3.79	<0.001
β_{Milk}	-0.0009	0.0051	-0.18	0.854	$\theta_{\text{Water}}: \ln \text{ age}$	-0.0041	0.0007	-5.90	<0.001
β_{FoodH}	-0.6520	0.0144	-45.17	<0.001	$\theta_{\text{Water}}: 1/\text{size}$	0.0195	0.0011	18.46	<0.001
$\gamma_{\text{SSB,SSB}}$	-0.0119	0.0022	-5.32	<0.001	$\theta_{\text{Water}}: \text{educ yrs}$	0.0000	0.0001	0.24	0.814
$\gamma_{\text{SSB,OthSug}}$	0.0095	0.0009	10.18	<0.001	$\theta_{\text{Water}}: \text{female head}$	0.0040	0.0005	7.69	<0.001
$\gamma_{\text{OthSug,OthSug}}$	-0.0063	0.0006	-9.76	<0.001	$\theta_{\text{Milk}}: \ln \text{ age}$	0.0059	0.0008	7.22	<0.001
$\gamma_{\text{SSB,Water}}$	0.0258	0.0013	20.43	<0.001	$\theta_{\text{Milk}}: 1/\text{size}$	-0.0215	0.0013	-17.08	<0.001
$\gamma_{\text{OthSug,Water}}$	-0.0162	0.0007	-23.22	<0.001	$\theta_{\text{Milk}}: \text{educ yrs}$	0.0004	0.0001	5.16	<0.001
$\gamma_{\text{Water,Water}}$	-0.0737	0.0011	-68.15	<0.001	$\theta_{\text{Milk}}: \text{female head}$	0.0059	0.0006	9.55	<0.001
$\gamma_{\text{SSB,Milk}}$	0.0131	0.0014	9.12	<0.001	$\theta_{\text{FoodH}}: \ln \text{ age}$	0.1224	0.0024	51.91	<0.001
$\gamma_{\text{OthSug,Milk}}$	0.0131	0.0009	15.22	<0.001	$\theta_{\text{FoodH}}: 1/\text{size}$	-0.2479	0.0039	-63.42	<0.001
$\gamma_{\text{Water,Milk}}$	0.0044	0.0011	4.09	<0.001	$\theta_{\text{FoodH}}: \text{educ yrs}$	-0.0042	0.0002	-19.58	<0.001
$\gamma_{\text{Milk,Milk}}$	-0.0046	0.0015	-2.99	0.003	$\theta_{\text{FoodH}}: \text{female head}$	0.0045	0.0020	2.30	0.021
$\gamma_{\text{SSB,FoodH}}$	-0.1512	0.0039	-38.81	<0.001	R_{11}	0.1311	0.0003	410.63	<0.001
$\gamma_{\text{OthSug,FoodH}}$	-0.0186	0.0023	-8.00	<0.001	R_{12}	0.0029	0.0004	6.99	<0.001
$\gamma_{\text{Water,FoodH}}$	0.0847	0.0031	27.29	<0.001	R_{22}	0.0747	0.0003	249.14	<0.001
$\gamma_{\text{Milk,FoodH}}$	-0.0745	0.0034	-22.16	<0.001	R_{13}	-0.0062	0.0005	-13.60	<0.001
$\gamma_{\text{FoodH,FoodH}}$	0.3184	0.0128	24.86	<0.001	R_{23}	0.0033	0.0005	6.35	<0.001
λ_{SSB}	0.0032	0.0007	4.68	<0.001	R_{33}	0.0861	0.0003	276.91	<0.001
λ_{OthSug}	-0.0088	0.0004	-23.37	<0.001	R_{14}	-0.0083	0.0005	-17.17	<0.001
λ_{Water}	-0.0242	0.0004	-56.18	<0.001	R_{24}	0.0020	0.0006	3.21	0.001
λ_{Milk}	-0.0047	0.0006	-8.36	<0.001	R_{34}	0.0014	0.0006	2.51	0.012
λ_{FoodH}	-0.0039	0.0016	-2.45	0.014	R_{44}	0.1122	0.0003	371.92	<0.001
					R_{15}	-0.0974	0.0017	-57.10	<0.001
					R_{25}	-0.0516	0.0021	-25.12	<0.001
					R_{35}	-0.0408	0.0019	-21.62	<0.001
					R_{45}	-0.0283	0.0017	-17.11	<0.001
					R_{55}	0.3534	0.0011	307.89	<0.001
Households	74,198				Log-likelihood	-5,556			
AIC	11,241				BIC	11,840			
Iterations	28				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); $z = \text{estimate}/\text{SE}$ and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. $\text{AIC} = 2 \cdot 65 - 2 \log L$, $\text{BIC} = 65 \log n - 2 \log L$.

Table D.5: Parameter estimates, 2016

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.1529	0.0082	18.69	<0.001	θ_{SSB} : ln age	-0.0163	0.0010	-16.88	<0.001
α_{OthSug}	-0.1532	0.0050	-30.88	<0.001	θ_{SSB} : 1/size	-0.0084	0.0015	-5.54	<0.001
α_{Water}	-0.4922	0.0036	-135.13	<0.001	θ_{SSB} : educ yrs	-0.0022	0.0001	-24.81	<0.001
α_{Milk}	0.0335	0.0078	4.31	<0.001	θ_{SSB} : female head	-0.0105	0.0008	-12.90	<0.001
α_{FoodH}	1.4504	0.0205	70.84	<0.001	θ_{OthSug} : ln age	-0.0152	0.0006	-25.63	<0.001
β_{SSB}	0.0364	0.0060	6.12	<0.001	θ_{OthSug} : 1/size	-0.0092	0.0010	-9.42	<0.001
β_{OthSug}	0.1392	0.0034	40.71	<0.001	θ_{OthSug} : educ yrs	0.0000	0.0001	0.73	0.465
β_{Water}	0.2520	0.0027	94.63	<0.001	θ_{OthSug} : female head	0.0024	0.0005	4.75	<0.001
β_{Milk}	-0.0013	0.0055	-0.23	0.819	θ_{Water} : ln age	-0.0057	0.0007	-7.78	<0.001
β_{FoodH}	-0.6691	0.0150	-44.67	<0.001	θ_{Water} : 1/size	0.0208	0.0011	18.19	<0.001
$\gamma_{SSB,SSB}$	-0.0148	0.0022	-6.60	<0.001	θ_{Water} : educ yrs	-0.0001	0.0001	-1.05	0.294
$\gamma_{SSB,OthSug}$	0.0101	0.0009	10.81	<0.001	θ_{Water} : female head	0.0041	0.0006	7.09	<0.001
$\gamma_{OthSug,OthSug}$	-0.0067	0.0007	-9.96	<0.001	θ_{Milk} : ln age	0.0062	0.0009	6.74	<0.001
$\gamma_{SSB,Water}$	0.0227	0.0013	17.73	<0.001	θ_{Milk} : 1/size	-0.0260	0.0014	-18.05	<0.001
$\gamma_{OthSug,Water}$	-0.0207	0.0007	-29.08	<0.001	θ_{Milk} : educ yrs	0.0005	0.0001	6.40	<0.001
$\gamma_{Water,Water}$	-0.0768	0.0010	-80.06	<0.001	θ_{Milk} : female head	0.0075	0.0007	10.47	<0.001
$\gamma_{SSB,Milk}$	0.0140	0.0015	9.30	<0.001	θ_{FoodH} : ln age	0.1258	0.0025	50.89	<0.001
$\gamma_{OthSug,Milk}$	0.0101	0.0009	11.53	<0.001	θ_{FoodH} : 1/size	-0.2739	0.0042	-64.58	<0.001
$\gamma_{Water,Milk}$	0.0021	0.0012	1.79	0.074	θ_{FoodH} : educ yrs	-0.0046	0.0002	-20.25	<0.001
$\gamma_{Milk,Milk}$	-0.0122	0.0016	-7.78	<0.001	θ_{FoodH} : female head	0.0017	0.0021	0.79	0.428
$\gamma_{SSB,FoodH}$	-0.1540	0.0038	-40.09	<0.001	R_{11}	0.1312	0.0003	398.32	<0.001
$\gamma_{OthSug,FoodH}$	-0.0151	0.0023	-6.50	<0.001	R_{12}	0.0027	0.0004	6.68	<0.001
$\gamma_{Water,FoodH}$	0.0924	0.0032	29.32	<0.001	R_{22}	0.0733	0.0003	260.59	<0.001
$\gamma_{Milk,FoodH}$	-0.0569	0.0035	-16.35	<0.001	R_{13}	-0.0065	0.0005	-13.92	<0.001
$\gamma_{FoodH,FoodH}$	0.3149	0.0128	24.58	<0.001	R_{23}	0.0035	0.0005	6.58	<0.001
λ_{SSB}	0.0030	0.0007	4.66	<0.001	R_{33}	0.0871	0.0003	280.00	<0.001
λ_{OthSug}	-0.0100	0.0004	-26.85	<0.001	R_{14}	-0.0108	0.0005	-20.81	<0.001
λ_{Water}	-0.0244	0.0004	-56.21	<0.001	R_{24}	0.0016	0.0006	2.47	0.013
λ_{Milk}	-0.0044	0.0006	-7.34	<0.001	R_{34}	0.0016	0.0006	2.64	0.008
λ_{FoodH}	-0.0030	0.0015	-1.99	0.046	R_{44}	0.1167	0.0003	368.04	<0.001
					R_{15}	-0.0940	0.0017	-54.84	<0.001
					R_{25}	-0.0452	0.0020	-22.44	<0.001
					R_{35}	-0.0399	0.0019	-20.72	<0.001
					R_{45}	-0.0348	0.0017	-20.61	<0.001
					R_{55}	0.3498	0.0012	299.33	<0.001
Households	69,848				Log-likelihood	-3,801			
AIC	7,733				BIC	8,328			
Iterations	28				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); z = estimate/SE and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. AIC = $2 \cdot 65 - 2 \log L$, BIC = $65 \log n - 2 \log L$.

Table D.6: Parameter estimates, 2014

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.0728	0.0158	4.61	<0.001	θ_{SSB} : ln age	-0.0162	0.0017	-9.39	<0.001
α_{OthSug}	-0.1716	0.0089	-19.22	<0.001	θ_{SSB} : 1/size	-0.0027	0.0025	-1.11	0.267
α_{Water}	-0.3134	0.0116	-27.08	<0.001	θ_{SSB} : educ yrs	-0.0017	0.0001	-11.84	<0.001
α_{Milk}	-0.0856	0.0148	-5.80	<0.001	θ_{SSB} : female head	-0.0069	0.0013	-5.30	<0.001
α_{FoodH}	1.4025	0.0417	33.66	<0.001	θ_{OthSug} : ln age	-0.0166	0.0010	-16.34	<0.001
β_{SSB}	0.0835	0.0111	7.51	<0.001	θ_{OthSug} : 1/size	-0.0084	0.0015	-5.43	<0.001
β_{OthSug}	0.1549	0.0060	25.92	<0.001	θ_{OthSug} : educ yrs	-0.0002	0.0001	-2.20	0.028
β_{Water}	0.1477	0.0079	18.79	<0.001	θ_{OthSug} : female head	0.0027	0.0008	3.52	<0.001
β_{Milk}	0.0743	0.0103	7.21	<0.001	θ_{Water} : ln age	-0.0060	0.0012	-4.87	<0.001
β_{FoodH}	-0.6253	0.0297	-21.04	<0.001	θ_{Water} : 1/size	0.0152	0.0019	7.86	<0.001
$\gamma_{SSB,SSB}$	-0.0095	0.0042	-2.26	0.024	θ_{Water} : educ yrs	-0.0002	0.0001	-1.90	0.057
$\gamma_{SSB,OthSug}$	0.0108	0.0017	6.34	<0.001	θ_{Water} : female head	0.0051	0.0010	5.32	<0.001
$\gamma_{OthSug,OthSug}$	-0.0122	0.0014	-9.06	<0.001	θ_{Milk} : ln age	0.0047	0.0016	2.89	0.004
$\gamma_{SSB,Water}$	0.0142	0.0018	7.81	<0.001	θ_{Milk} : 1/size	-0.0170	0.0024	-7.08	<0.001
$\gamma_{OthSug,Water}$	-0.0165	0.0010	-15.83	<0.001	θ_{Milk} : educ yrs	0.0007	0.0001	5.16	<0.001
$\gamma_{Water,Water}$	-0.0386	0.0020	-18.93	<0.001	θ_{Milk} : female head	0.0071	0.0012	5.94	<0.001
$\gamma_{SSB,Milk}$	0.0121	0.0028	4.26	<0.001	θ_{FoodH} : ln age	0.1081	0.0044	24.38	<0.001
$\gamma_{OthSug,Milk}$	0.0027	0.0016	1.67	0.094	θ_{FoodH} : 1/size	-0.2527	0.0073	-34.45	<0.001
$\gamma_{Water,Milk}$	-0.0080	0.0017	-4.74	<0.001	θ_{FoodH} : educ yrs	-0.0040	0.0004	-10.37	<0.001
$\gamma_{Milk,Milk}$	-0.0150	0.0035	-4.23	<0.001	θ_{FoodH} : female head	-0.0054	0.0035	-1.52	0.129
$\gamma_{SSB,FoodH}$	-0.1207	0.0072	-16.67	<0.001	R_{11}	0.1231	0.0006	205.33	<0.001
$\gamma_{OthSug,FoodH}$	-0.0175	0.0045	-3.84	<0.001	R_{12}	0.0027	0.0007	4.10	<0.001
$\gamma_{Water,FoodH}$	0.0385	0.0053	7.25	<0.001	R_{22}	0.0668	0.0005	141.90	<0.001
$\gamma_{Milk,FoodH}$	-0.0358	0.0068	-5.24	<0.001	R_{13}	-0.0061	0.0008	-7.28	<0.001
$\gamma_{FoodH,FoodH}$	0.2498	0.0261	9.55	<0.001	R_{23}	0.0017	0.0009	1.79	0.073
λ_{SSB}	-0.0011	0.0012	-0.89	0.375	R_{33}	0.0853	0.0006	148.65	<0.001
λ_{OthSug}	-0.0103	0.0007	-14.12	<0.001	R_{14}	-0.0080	0.0010	-8.22	<0.001
λ_{Water}	-0.0121	0.0008	-14.95	<0.001	R_{24}	0.0018	0.0011	1.55	0.121
λ_{Milk}	-0.0122	0.0011	-10.64	<0.001	R_{34}	0.0012	0.0011	1.09	0.274
λ_{FoodH}	-0.0012	0.0032	-0.39	0.695	R_{44}	0.1129	0.0006	189.90	<0.001
					R_{15}	-0.0953	0.0031	-30.39	<0.001
					R_{25}	-0.0314	0.0036	-8.79	<0.001
					R_{35}	-0.0402	0.0034	-11.81	<0.001
					R_{45}	-0.0423	0.0030	-14.04	<0.001
					R_{55}	0.3296	0.0021	160.20	<0.001
Households	19,356				Log-likelihood	1,450			
AIC	-2,769				BIC	-2,258			
Iterations	24				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); z = estimate/SE and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. AIC = $2 \cdot 65 - 2 \log L$, BIC = $65 \log n - 2 \log L$.

Table D.7: Parameter estimates, 2012

Parameter	Est.	SE	z	p	Parameter	Est.	SE	z	p
α_{SSB}	0.0463	0.0248	1.87	0.061	θ_{SSB} : ln age	-0.0233	0.0025	-9.42	<0.001
α_{OthSug}	-0.1260	0.0136	-9.26	<0.001	θ_{SSB} : 1/size	-0.0034	0.0034	-1.00	0.315
α_{Water}	-0.2992	0.0164	-18.23	<0.001	θ_{SSB} : educ yrs	-0.0019	0.0002	-9.14	<0.001
α_{Milk}	-0.2301	0.0207	-11.10	<0.001	θ_{SSB} : female head	-0.0082	0.0019	-4.26	<0.001
α_{FoodH}	1.6419	0.0577	28.46	<0.001	θ_{OthSug} : ln age	-0.0183	0.0016	-11.73	<0.001
β_{SSB}	0.1130	0.0173	6.54	<0.001	θ_{OthSug} : 1/size	-0.0092	0.0022	-4.26	<0.001
β_{OthSug}	0.1402	0.0095	14.71	<0.001	θ_{OthSug} : educ yrs	-0.0001	0.0001	-0.90	0.366
β_{Water}	0.1273	0.0113	11.24	<0.001	θ_{OthSug} : female head	0.0014	0.0011	1.19	0.233
β_{Milk}	0.1090	0.0153	7.13	<0.001	θ_{Water} : ln age	-0.0046	0.0019	-2.48	0.013
β_{FoodH}	-0.6725	0.0436	-15.44	<0.001	θ_{Water} : 1/size	0.0055	0.0028	1.95	0.051
$\gamma_{SSB,SSB}$	-0.0077	0.0055	-1.40	0.162	θ_{Water} : educ yrs	0.0002	0.0002	1.17	0.243
$\gamma_{SSB,OthSug}$	0.0061	0.0025	2.42	0.016	θ_{Water} : female head	0.0036	0.0015	2.50	0.012
$\gamma_{OthSug,OthSug}$	-0.0082	0.0019	-4.39	<0.001	θ_{Milk} : ln age	0.0096	0.0026	3.70	<0.001
$\gamma_{SSB,Water}$	0.0110	0.0025	4.34	<0.001	θ_{Milk} : 1/size	-0.0125	0.0035	-3.52	<0.001
$\gamma_{OthSug,Water}$	-0.0098	0.0015	-6.69	<0.001	θ_{Milk} : educ yrs	0.0008	0.0002	3.96	<0.001
$\gamma_{Water,Water}$	-0.0359	0.0027	-13.29	<0.001	θ_{Milk} : female head	0.0063	0.0019	3.28	0.001
$\gamma_{SSB,Milk}$	-0.0052	0.0047	-1.12	0.261	θ_{FoodH} : ln age	0.1089	0.0073	14.93	<0.001
$\gamma_{OthSug,Milk}$	-0.0022	0.0026	-0.85	0.394	θ_{FoodH} : 1/size	-0.2458	0.0109	-22.63	<0.001
$\gamma_{Water,Milk}$	-0.0205	0.0025	-8.07	<0.001	θ_{FoodH} : educ yrs	-0.0045	0.0006	-7.17	<0.001
$\gamma_{Milk,Milk}$	-0.0390	0.0062	-6.25	<0.001	θ_{FoodH} : female head	0.0060	0.0056	1.06	0.288
$\gamma_{SSB,FoodH}$	-0.0764	0.0123	-6.19	<0.001	R_{11}	0.1188	0.0009	136.26	<0.001
$\gamma_{OthSug,FoodH}$	0.0022	0.0073	0.31	0.759	R_{12}	0.0037	0.0010	3.74	<0.001
$\gamma_{Water,FoodH}$	0.0621	0.0080	7.79	<0.001	R_{22}	0.0670	0.0007	96.28	<0.001
$\gamma_{Milk,FoodH}$	0.0186	0.0121	1.53	0.126	R_{13}	-0.0016	0.0013	-1.28	0.202
$\gamma_{FoodH,FoodH}$	0.0061	0.0429	0.14	0.887	R_{23}	0.0034	0.0015	2.32	0.020
λ_{SSB}	-0.0008	0.0020	-0.42	0.676	R_{33}	0.0855	0.0009	91.83	<0.001
λ_{OthSug}	-0.0082	0.0011	-7.30	<0.001	R_{14}	-0.0055	0.0016	-3.52	<0.001
λ_{Water}	-0.0104	0.0013	-8.15	<0.001	R_{24}	0.0035	0.0018	1.90	0.057
λ_{Milk}	-0.0186	0.0018	-10.36	<0.001	R_{34}	0.0051	0.0018	2.88	0.004
λ_{FoodH}	0.0025	0.0049	0.51	0.610	R_{44}	0.1207	0.0009	134.75	<0.001
					R_{15}	-0.1016	0.0048	-21.34	<0.001
					R_{25}	-0.0501	0.0058	-8.70	<0.001
					R_{35}	-0.0460	0.0057	-8.08	<0.001
					R_{45}	-0.0578	0.0049	-11.83	<0.001
					R_{55}	0.3485	0.0032	107.67	<0.001
Households	8,929				Log-likelihood	-206			
AIC	541				BIC	1,002			
Iterations	23				Converged	yes			

Note: Free parameters of the wave's censored QUAIDS in estimation order; the γ and R blocks list the upper triangle column by column, and the θ rows give each equation's four demographic shifters. Standard errors are asymptotic (outer product of gradients); z = estimate/SE and p is the two-sided normal p -value. The dropped food-away-from-home equation is recovered from adding-up; $\Sigma = R'R$ is the error covariance. $AIC = 2 \cdot 65 - 2 \log L$, $BIC = 65 \log n - 2 \log L$.