



Taxes and Subsidies on Food, Beverages, and Ingredients

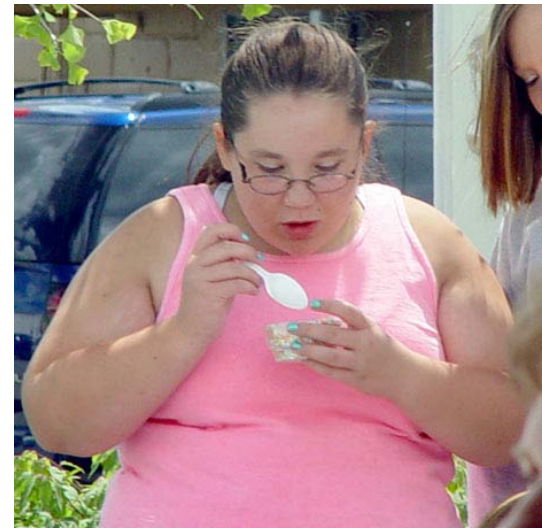
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See our paper: Taxing Sweets: Sweetener Input Tax
or Final Consumption Tax?

Available on line at:

<http://ageconsearch.umn.edu/handle/61511>



Motivation

- ▶ High rates of obesity and overweight
- ▶ Contributors to increased calories (1970–2003):
 - Fats and oils (216 calories), refined grains (188 calories), all sweeteners (76 calories)
- ▶ Recent tax proposals
 - Tax snack foods or fat/content
 - Tax soft drinks
- ▶ Literature focuses on consumption tax, finds effectiveness of tax policy limited. Taxes are regressive, but \$ loss to consumers is small



Objectives

- ▶ Focus on a sweet tax policy to reduce added sweetener consumption (and related calories)
- ▶ Compare effects of two types of taxes
 - A consumption tax on sweet goods
 - A sweetener input tax in food production
- ▶ Set a reduction of added-sweetener consumption as the policy target while minimizing \$ loss
- ▶ Analyze the distributional effect of tax instruments



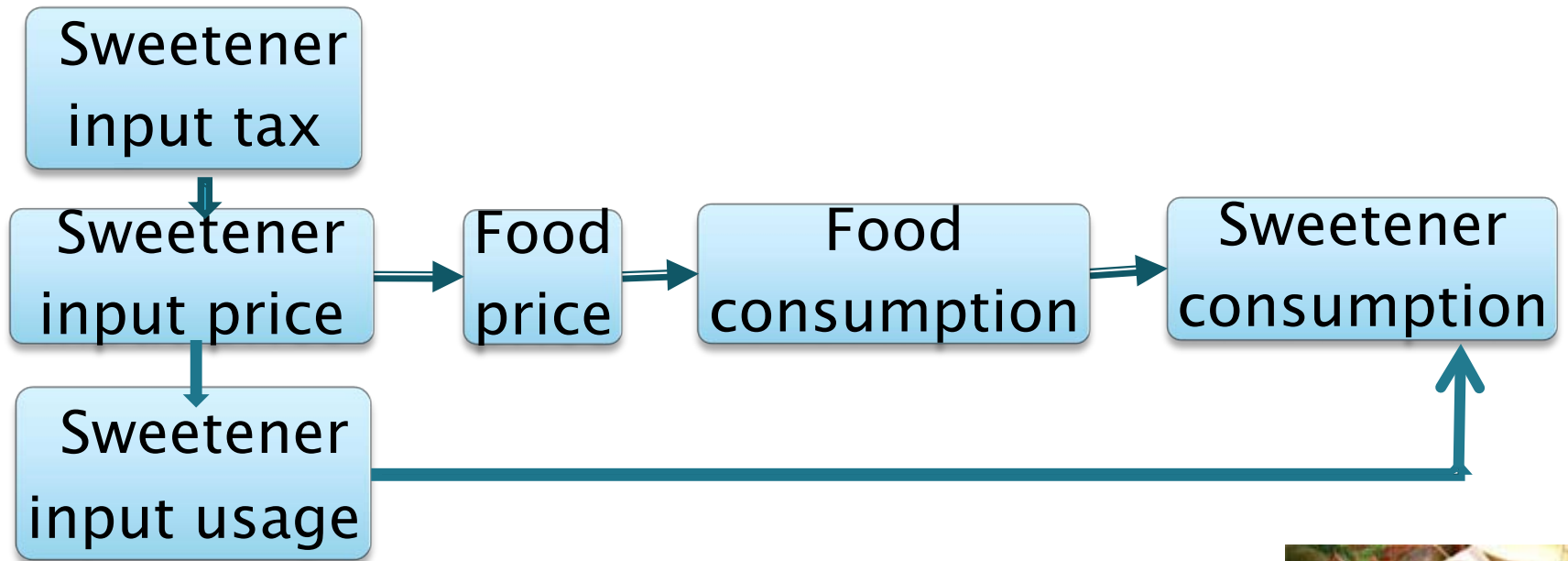
Two Policy Mechanisms

1. Sweet tax on the consumption level



Two Policy Mechanisms

2. Sweetener tax on the production level



Model

- ▶ Four added sweeteners markets
 - Assumes an infinite supply in the added sweeteners markets –added sweeteners’ prices remain constant
- ▶ Nine sweetener–intensive food markets
 - Supply: Food processors supply sweetener–intensive foods
 - Demand: Consumers buy sweetener–intensive foods
 - considers equilibrium between supply and demand and their changes with taxes
 - evaluates consumer welfare changes



Producers' Side

- ▶ Changes in food production cost are fully transmitted to the consumer level
- ▶ Relative unit cost change is equal to a weighted sum of relative input prices' changes
- ▶ The tax on any sweetener input
 - makes processor economize on this more expensive sweetener and substitute other sweeteners
 - leads to a higher unit cost and consumer price for the good

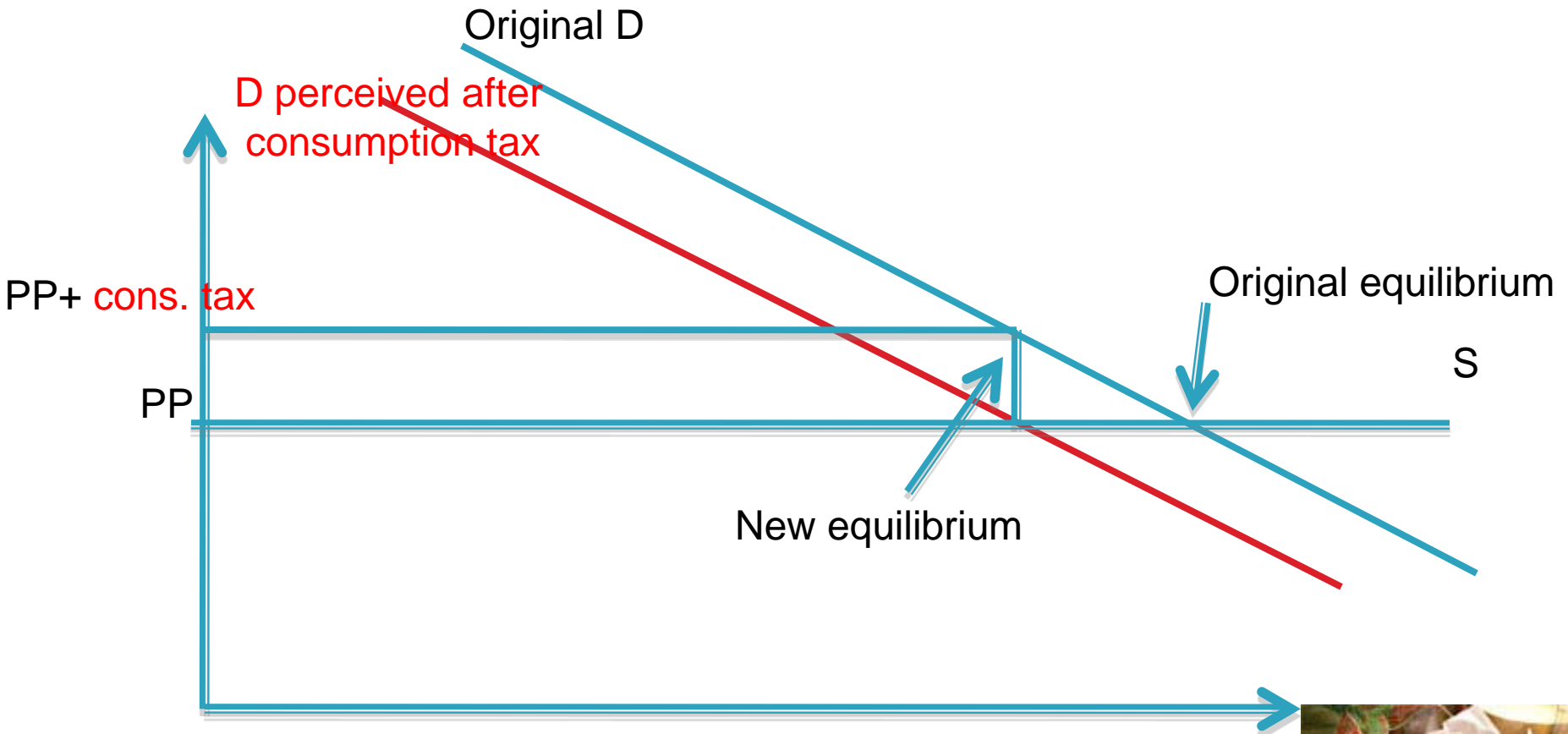


Consumers' Side -All households

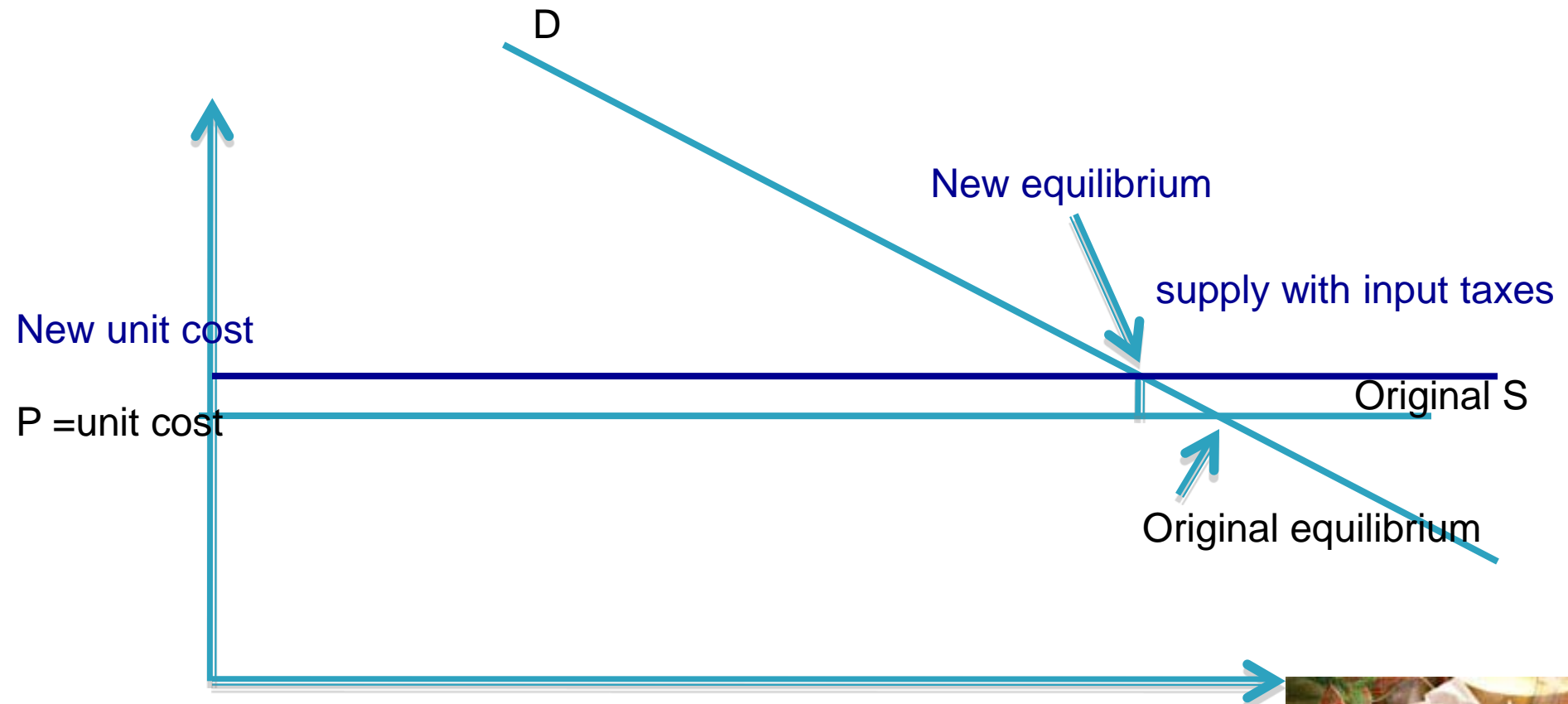
- ▶ Uses an incomplete demand system approach for nine sweetener-intensive final goods (LinQuad Marshallian demand equations)
- ▶ Allows for “exact” welfare computation implications of the tax policies via a close form EV (measure of monetary compensation for higher prices)
- ▶ Does not include the health benefits of reduced sweetener consumption. Provides an upper bound on the welfare cost of higher food prices



The effect of the consumption tax



The effect of an input tax on sweetener inputs



Data-Production of Sweetener-Intensive Foods

- ▶ Cost share of sweeteners in the food production as share of the materials consumed by each industry
 - Economic Census Industry Series Report (U.S. Dept of Commerce, 2002)
- ▶ Account for outputs of some industries used as intermediate inputs by other industries to capture all sweeteners included in goods



Data- Consumption

- ▶ Calibrate the 2002 Economic Census Industry Series Reports (Manufacturing) value of shipments to consumption with focus on 4 sweetener inputs and 9 sweetener-intensive food groups
- ▶ Ratio of adjustment: ratio of food disappearance data to the production data
 - Food availability dataset (USDA/ERS, 2008) to look at 5 income quintile groups



Policy Simulation and Welfare Evaluation

- ▶ Consumption tax and input tax designed to reach the same target of
 - reduce quantity of all sweeteners for all households by 10% (a basis of equivalence)
 - minimize the associated market welfare loss to all households
- ▶ We simulate several policy shocks but report 2 here
 - an final tax on final products
 - an input tax on all caloric sweeteners



Nine Target Sweetener–Intensive Food Demand Change under Two Tax Scenarios on All Households

Food	Ad valorem tax on price of final products		Tax on Caloric Sweeteners input combined		
			Tax rate (%)		
			Sugars	Corn Sweeteners	Other Sweeteners
			27.47%	42.95%	<0.01%
	Tax rate (%)	Food demand change (%)	New price with tax	Food demand change (%)	
Milk	0.00	0.21	1.00	-0.37	
Cheese	0.00	1.43	1.00	0.00	
Ice cream / yogurt	0.00	0.03	1.01	-0.56	
Breakfast cereal / Bakery	0.00	0.80	1.01	-0.23	
Soft drink	0.00	0.01	1.01	-1.18	
Juice	0.00	1.89	1.00	-0.10	
Sweetener products	39.30	-19.82	1.03	-1.50	
Processed fruits and vegetables	0.01	0.50	1.00	-0.58	
Condiments / Spices	0.00	-0.02	1.00	-0.15	

Sweeteners Consumption Quantity Changes on All Households and Disaggregated Income Groups for Nine Sweetener-Intensive Foods

	All households	Households by quintiles	
		Lowest 20%	Highest 20%
Sweeteners consumption quantity change	Change with tax on the price of Final Products (%)		
All Sweeteners (sugar equivalent)	-10.00	-13.10	-6.26
Sugars	-13.39	-19.78	-9.49
Corn Sweeteners	-2.27	-3.40	-1.62
Other Sweeteners	-1.08	-1.65	-0.76
Artificial Sweeteners	-13.14	-19.62	-9.27
Sweeteners consumption quantity change	Change with tax on the price of Caloric Sweeteners (%)		
All Sweeteners (sugar equivalent)	-10.00	-10.45	-9.73
Sugars	-8.95	-9.46	-8.67
Corn Sweeteners	-12.41	-12.80	-12.17
Other Sweeteners	3.22	3.07	3.33
Artificial Sweeteners	1.32	0.68	1.70

Real Expenditure Changes and Welfare Losses for Nine Sweetener-Intensive Foods

	All households	Households by quintiles	
		Lowest 20%	Highest 20%

Tax on the price of Final Products

Real expenditure change (%)	1.86	0.51	2.70
Per capita EV (dollars)	-31.00	-29.04	-35.00
EV/Income (%)	0.17	0.60	0.10

Tax on the price of Caloric Sweeteners

Real expenditure change (%)	0.28	0.01	0.43
Per capita EV (dollars)	-5.98	-5.86	-6.54
EV/Income (%)	0.03	0.12	0.02

Result Summary and Policy Implications

- ▶ The consumption tax zeros in on one food group (sweeteners). More efficient than a soda tax!
- ▶ The sweetener input tax on food processor abate caloric sweeteners more effectively with smaller consumer price effects
- ▶ Average loss in welfare is small in \$ and share of income but taxes
- ▶ Both tax instruments are regressive but one is much more efficient (EV 5 times smaller)
- ▶ A small income subsidy (\$30) would compensate
 - Regressive nature overstated as an obstacle



Limitations and Extensions

- ▶ Ignore longer run health benefits derived from reduced sweetener consumption.
- ▶ Overstate the loss in welfare and the regressive nature of the tax
- ▶ Do not account for substitution between the added sugar and fat component or within group effects
- ▶ Do not account for differences between food at home and food away from home
- ▶ Income is the sole demographic variable



Per Capita Income and Food Expenditure Distribution among Nine Sweetener-Intensive Foods (Dollars)

	Quintiles of income		
	All households	Lowest 20%	Highest 20%
Average annual income after taxes	18773.60	4857.46	35049.03
Annual food expenditure (per capita)	726.13	702.63	793.57
Milk	100.44	104.98	98.18
Cheese	65.55	60.44	75.57
Ice cream / yogurt	27.39	25.26	31.58
Breakfast cereal / Bakery	149.78	150.03	164.84
Soft drink	118.41	114.12	129.86
Juice	42.96	41.98	47.40
Sweetener products	87.56	86.58	95.78
Processed fruits and vegetables	29.39	28.84	31.53
Condiments / Spices	104.65	90.40	118.83
Sweeteners (pounds)			
All Sweeteners (sugar equivalent)	105.69	103.83	115.37
Sugars	61.90	61.21	67.67
Corn Sweeteners	54.81	53.41	59.63
Other Sweeteners	2.86	2.72	3.17
Artificial Sweeteners	0.54	0.53	0.59

Categories of the Sweeteners in the U.S. Food Manufacturing Industry

Sweeteners Group	Material code	Materials consumed
Sugars	31131001	Sugar, cane and beet (sugar solids)
	31131005	Sugar, cane and beet (sugar solids), excluding brown
	31131009	Brown sugar, cane and beet (sugar solids)
	31131100	Raw cane sugar (converted to 96 percent basis)
	11193000	Sugar cane
	11199100	Sugar beets
Corn sweeteners	31122101	Corn syrup
	31122103	High fructose corn syrup (HFCS) (solids)
	31122105	Fructose corn syrup (50 percent or less) (solids)
	31122107	Fructose corn syrup (50 percent or more) (solids)
	31122111	Glucose syrup (corn syrup), conventional and regular (solids)
	31122117	Crystalline fructose (dry fructose)
	31122119	Dextrose and corn syrup, including corn syrup solids (dry weight)
Other sweeteners	31100003	Other natural sweeteners
Artificial sweeteners	32510053	Sugar substitutes (mannitol, sorbitol, etc.)
	32510057	Artificial sweeteners (solids)

Elasticities of Nine Target Sweetener-Intensive Foods

Food	Milk	Cheese	Ice cream / yogurt	Breakfast cereal / Bakery	Soft drink	Juice	Sweetener products	Processed fruits and vegs	Condiments / Spices	Income / Total Expenditure Elasticity
Milk	-0.72	-0.03		-0.03	-0.07	0.02	0.01	-0.01		0.03
Cheese		-1.07	-0.05	-0.04		-0.02	0.04	0.02		0.22
Ice cream / yogurt			-0.83	-0.03		0.00				-0.17
Breakfast cereal / Bakery				-0.47		0.01	0.02	0.02		0.23
Soft drink					-0.93	0.00				-0.03
Juice						-0.85	0.05	0.02		0.38
Sweetener products							-0.50	0.01		0.05
Processed fruits and vegs								-1.97		0.49
Condiments / Spices									-1.04	0.12

Cost Shares of Sweeteners in 9 Target Sweetener-Intensive U.S. Food Manufacturing Industry

Food	Cost Shares of Sweeteners (%)				
	Sugars	Corn Sweeteners	Other	Artificial	Total
Milk	0.52	0.73	0.00	0.00	1.25
Cheese	0.04	0.08	0.00	0.00	0.12
Ice cream / yogurt	1.15	1.02	0.00	0.00	2.17
Breakfast cereal / Bakery	1.89	0.41	0.28	0.03	2.61
Soft drink	0.18	3.36	0.13	0.10	3.76
Juice	0.22	0.72	0.00	0.00	0.93
Sweetener products	10.80	1.04	0.08	0.46	12.37
Processed fruits/vegs	0.22	0.79	0.00	0.00	1.02
Condiments / Spices	0.28	0.20	0.28	0.03	0.80

Results: sweeteners consumption change

- ▶ Ad valorem tax on final products
 - All four types of sweeteners decrease in quantity
- ▶ Tax on Caloric Sweetener inputs
 - Fall in the quantities of Sugars and Corn Sweeteners
- ▶ Taxing individual sweetener input
 - Only lowers the quantity of the particular sweetener that is taxed



Results: Tax rate and associated demand changes for 10% target

- ▶ Ad valorem tax on final products
 - 39% tax on “Sweetener products”
 - 20% reduction in “Sweetener products” consumption
- ▶ Tax on Caloric Sweetener inputs
 - Sugars at 27%
 - Corn sweetener at 43%
 - Increase of final good price of less than 4%
 - Highest final good demand decreases (over 1%) on “Soft drinks” and “Sweetener products”
 - Sweetener intensity of goods falls

