14.03/003 Microeconomic Theory & Public Policy Fall 2022

Lecture 9. Applied Competitive Analysis: The U.S. Sugar Program

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Announcement #1

1. For the next lecture, **read** Hsieh and Moretti, "Can Free Entry Be Inefficient? Fixed Commissions and Social Waste in the Real Estate Industry" *JPE* 2003

Applied Competitive Analysis: The U.S. Sugar Quota Policy

U.S. sugar production and consumption

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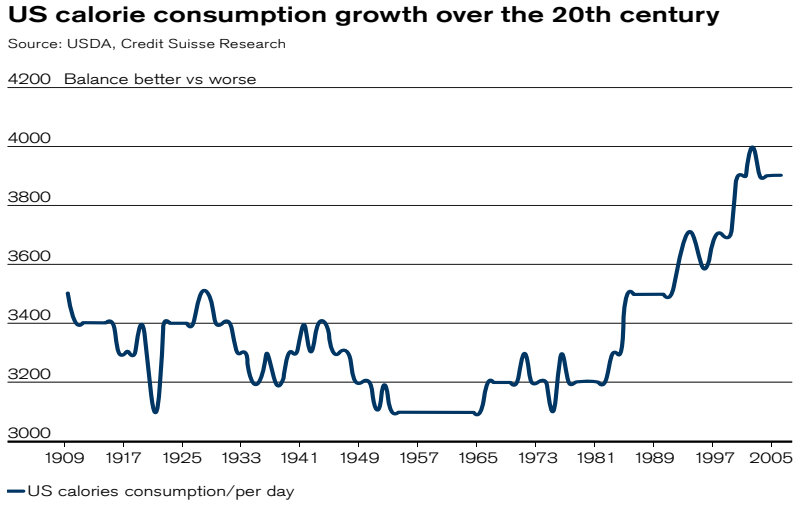
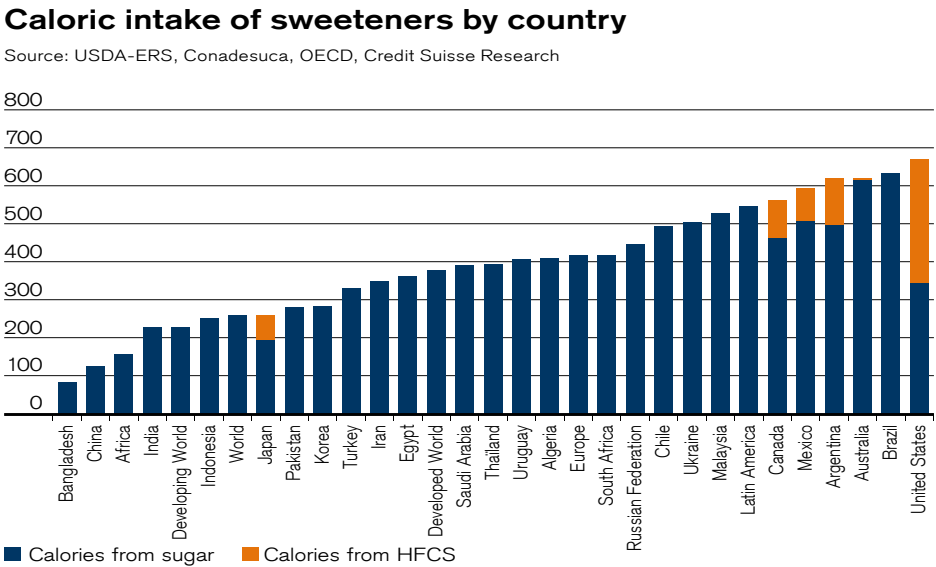
- The U.S. sugar industry has 'enjoyed' trade protection since 1789 when Congress enacted the first tariff against foreign-produced sugar
- Current policies date to the Reagan Administration in 1982 (*The Agriculture and Food Act of 1981*)

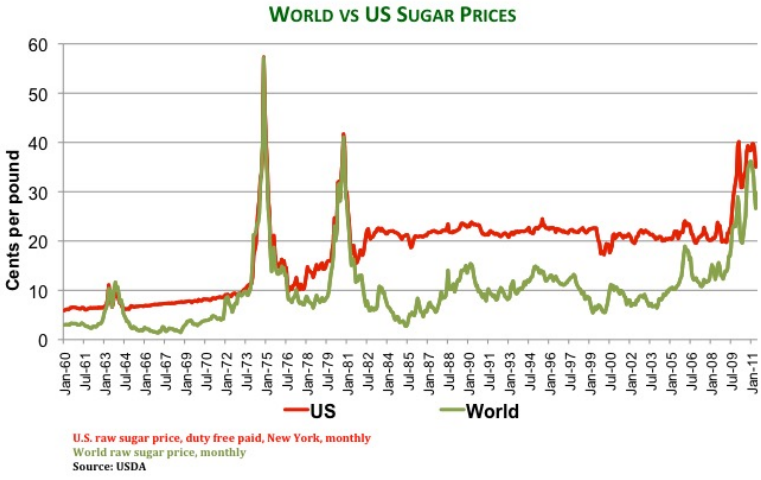
U.S. mean per capita daily calorie consumption over the 20th century



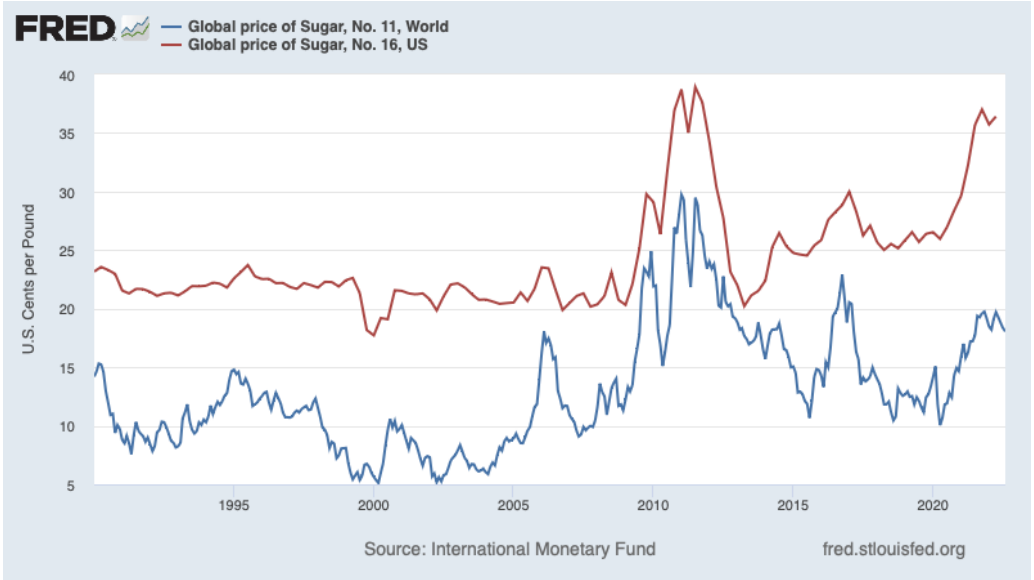
Daily caloric input of sweeteners by country



U.S. vs world sugar prices, 1960-2011



U.S. vs world sugar prices, 1990-2020



What are the sources of nutritive sweetener supply to the US market?

1. US producers
2. High Fructose Corn Syrup producers
3. Foreign suppliers: Infinitely elastic supply at \$0.068/lb

Note that there is only one source of demand: Consumers

Information given about domestic sugar supply

- *Some* U.S. sugar producers are competitive at the world price of $\$0.068$/lb. We'll think of *some* as a very small number ≈ 0
- Total U.S. domestic supply of sugar is 13.2 billion pounds at $\$0.22$/lb
- We can use this information to construct a **domestic supply curve**, assuming linearity:

$$\begin{aligned} S(P) &= \alpha_s \times (P - 0.068) \\ 13.2 &= \alpha_s \times (0.22 - 0.068) \\ \alpha_s &= 86.84 \\ S(P) &= 86.84 \times (P - 0.068) \end{aligned}$$

Information given about domestic sugar demand

- U.S. sugar demand at the quota price of \$0.22 is 29 billion lbs.
- The U.S. domestic elasticity of demand for sugar $\sigma = -0.30$
- We can use these data (a point and a slope) to construct the demand curve
- We'll use the following functional form: $\boldsymbol{Q(P) = \alpha_d P^{\sigma}}$
- Here's why

$$\begin{aligned} \sigma &\equiv \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} \\ \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} &= \sigma \alpha_d P^{\sigma-1} \times \frac{P}{\alpha_d P^{\sigma}} \\ &= \sigma \end{aligned}$$

Solving for the U.S. sugar demand curve

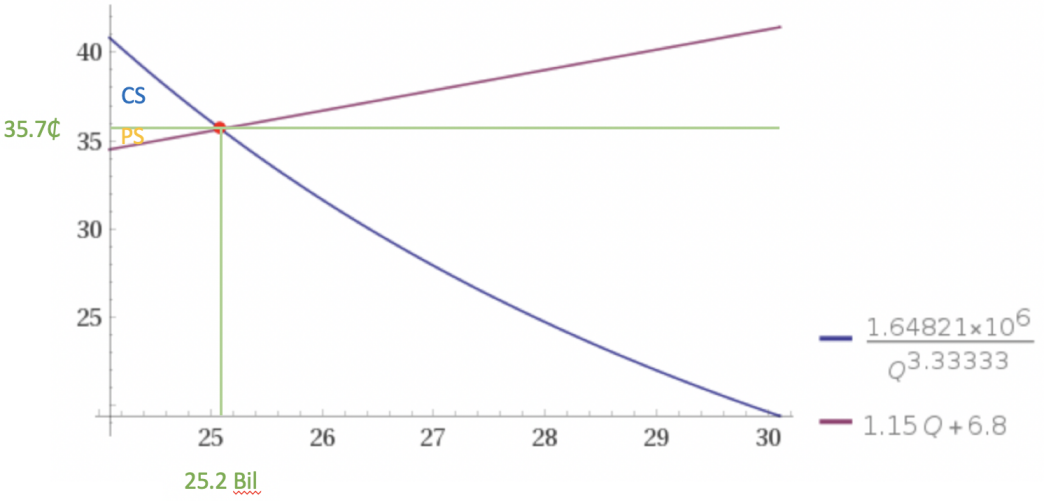
- Solving for the demand curve

$$\begin{aligned} 29 &= \alpha_0 \times 22^{-0.30} \\ \alpha_0 &= 29 \times 22^{0.30} = 73.3 \\ Q\left(22\right) &= 73.3(22)^{-0.30} \\ Q\left(P\right) &= 73.3P^{-0.30} \end{aligned}$$

- Solving for quantity demanded at the world price

$$Q\left(6.8\right) = 73.3 \times \left(6.8\right)^{-0.30} = 41.2 \text{ billion pounds}$$

Market clearing: hypothetical domestic sugar market



Market clearing: hypothetical domestic sugar market

– Note that to plot these demand and supply curves, I inverted the functions (p as a f'n of Q rather than Q as a f'n of p)

$$p_d(Q) = \left(\frac{73.3}{Q}\right)^{\frac{1}{0.3}}$$

$$p_s(Q) = 6.8 + 1.15Q$$

FY 2018 WTO tariff-rate quota allocations

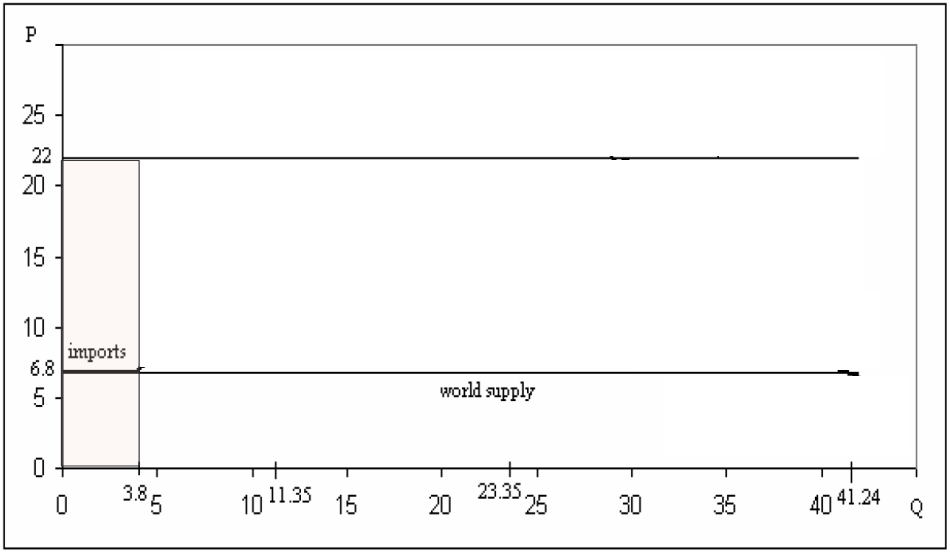
Raw cane, refined & specialty, and sugar-containing products

Country	(MTRV)
Argentina	45,281
Australia	87,402
Barbados	7,371
Belize	11,584
Bolivia	8,424
Brazil	152,691
Colombia	25,273
Congo	7,258
Costa Rica	15,796
Cote d'Ivoire	7,258
Dominican Republic	185,335
Ecuador	11,584
El Salvador	27,379
Fiji	9,477
Gabon	7,258
Guatemala	50,546
Guyana	12,636
Haiti	7,258
Honduras	10,530
India	8,424
Jamaica	11,584
Madagascar	7,258
Malawi	10,530
Mauritius	12,636
Mexico	7,258
Mozambique	13,690
Nicaragua	22,114
Panama	30,538
Papua New Guinea	7,258
Paraguay	7,258
Peru	43,175
Philippines	142,160
South Africa	24,220
St. Kitts & Nevis	7,258
Swaziland	16,849
Taiwan	12,636
Thailand	14,743
Trinidad & Tobago	7,371
Uruguay	7,258
Zimbabwe	12,636

Sources of nutritive sweetener supply

1. US producers: ≈ 0bil lb at \$0.068/lb, 13.2bil lb at \$0.22/lb
2. High Fructose Corn Syrup producers: 12.0bil lb at \$0.15/lb
3. Foreign suppliers: Infinitely elastic supply at \$0.068/lb

U.S. Domestic sugar market: Supply and demand



Cost and benefit accounting

	Sugar Imports at $0.22.lb	Domestic Sugar Production	HFCS Production	Foregone Con-sumption*	Total
Quantity (Billions Lbs)	3.8 bil				
Δ Expenditure	$0.84 bil				
Δ Producer Costs	$0.26 bil				
Δ Producer Surplus	$0.58 bil				
Δ Consumer Surplus	-$0.58 bil				
DWL	0				

* Calculated at price of $0.068/lb

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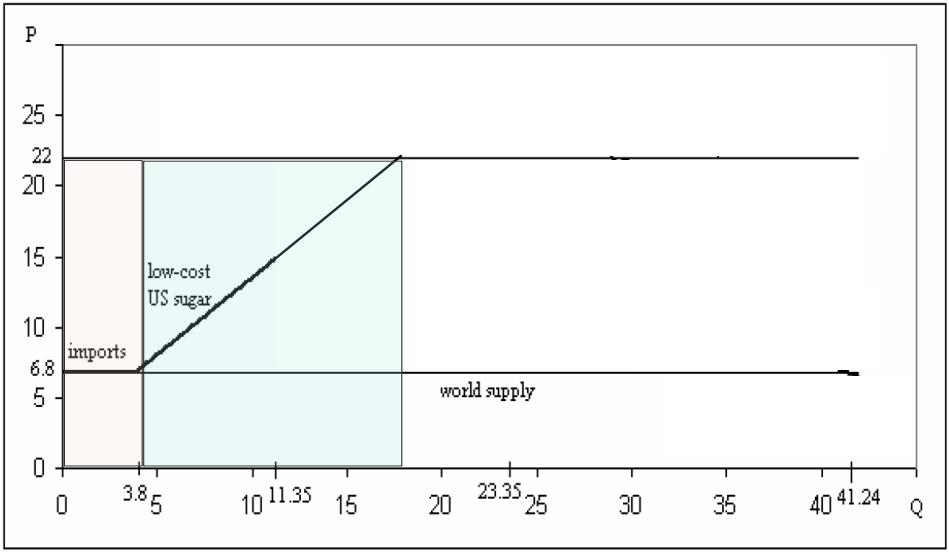

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Δ Consumer Surplus	-$0.58 bil	-2.0 bil			
DWL	0	$1.0 bil			

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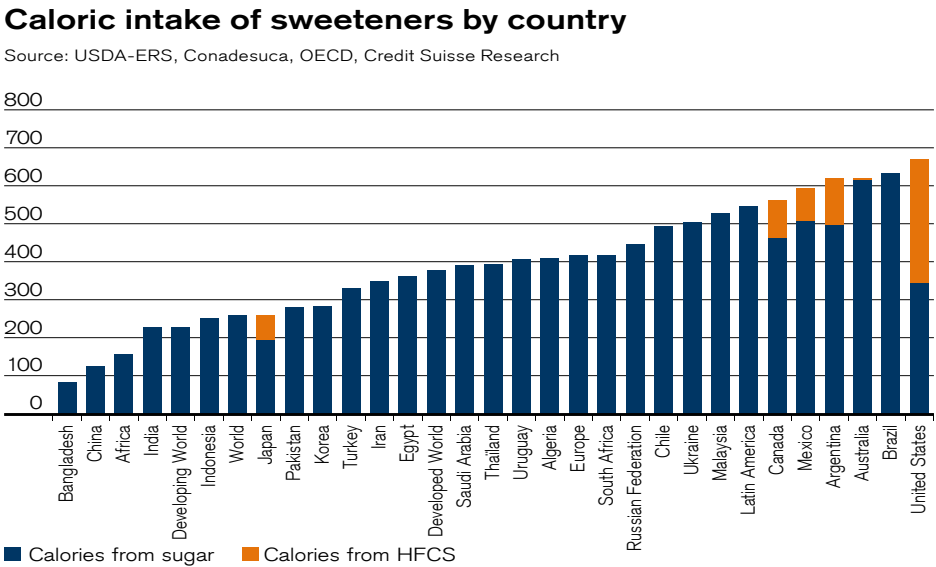
Daily caloric input of sweeteners by country



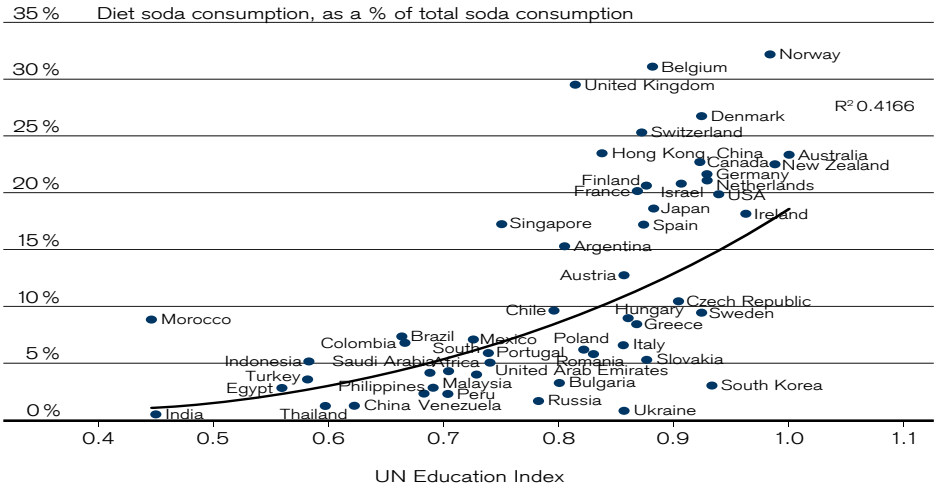
Cargill corn syrup plant

Cedar Rapids, Iowa, 2016

Archer Daniels Midland logo, 1962-2001

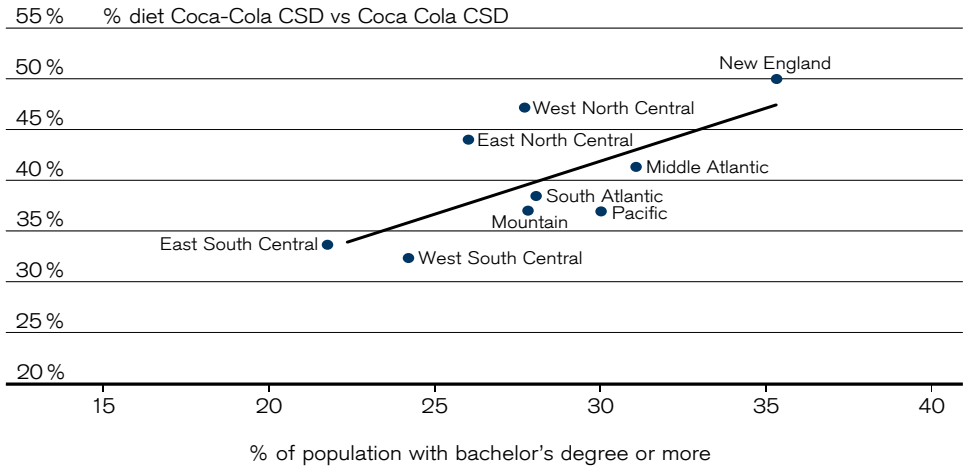
Diet soda consumption (as a % of total soda consumption) vs. relative educational standard

Source: Euromonitor, Nielsen XAOC, Credit Suisse estimates

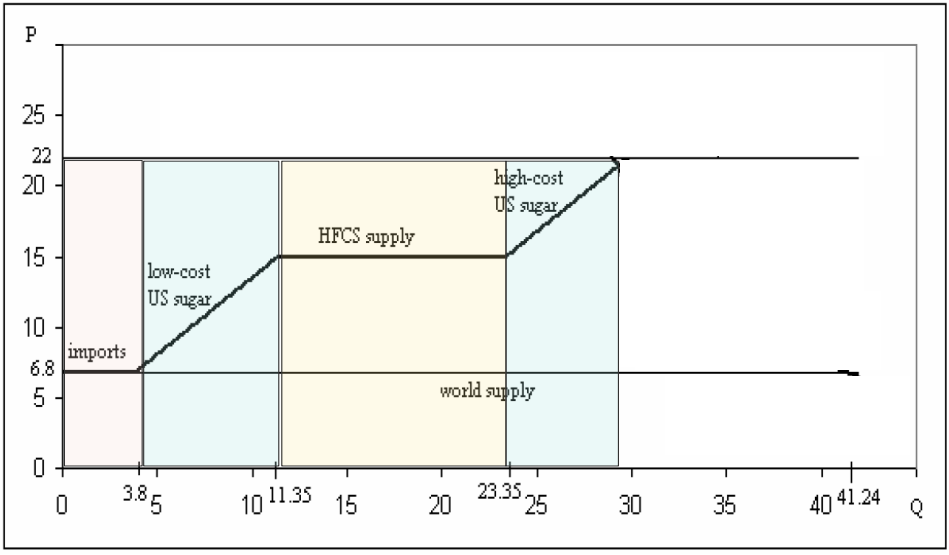


Diet soda consumption relative to the % of the population with a bachelor's degree or more

Source: Nielsen, http://www.census.gov/people/



U.S. domestic sugar market: Supply and demand



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Quantity (Billions Lbs)	3.8 bil	13.2 bil	12.0 bil		
Δ Expenditure	$0.84 bil	$2.9 bil	$2.64 bil		
Δ Producer Costs	$0.26 bil	$1.9 bil	$1.80 bil		
Δ Producer Surplus	$0.58 bil	$1.0 bil	$0.84 bil		
Δ Consumer Surplus	-$0.58 bil	-2.0 bil	-$1.82 bil		
DWL	0	$1.0 bil	$0.98 bil		

* Calculated at price of $0.068/lb

What are we missing?

Loss of consumer surplus from foregone consumption

- In the absence of the program, the domestic price of sugar would fall to \$0.068 per pound

Loss of consumer surplus from foregone consumption

- In the absence of the program, the domestic price of sugar would fall to \$0.068 per pound
- Loss in consumer surplus due to the programmatic imposition of a price of \$0.22 per pound

$$\int_{6.8}^{22} Q\left(P\right) \partial P = \int_{6.8}^{22} 73.3 P^{-0.3} \partial P = \left(\frac{73.3}{0.7}\right) P^{0.7} \Big]_{6.8}^{22} = \$5.1 \text{ billion}$$

Loss of consumer surplus from foregone consumption

- Loss of consumer surplus due to artificial price of \$0.22/lb

$$\int_{6.8}^{22} Q\left(P\right) \partial P = \int_{6.8}^{22} 73.3 P^{-0.3} \partial P = \left(\frac{73.3}{0.7}\right) P^{0.7} \Big]_{6.8}^{22} = \$5.1 \text{ billion}$$

- Composed of two pieces:

  1. Transfer from consumers to producers: Rectangular area of $(\$0.22 - \$0.068) \times 29$ billion $= \$4.4$ billion. Note: partly squandered on excess production costs

Loss of consumer surplus from foregone consumption

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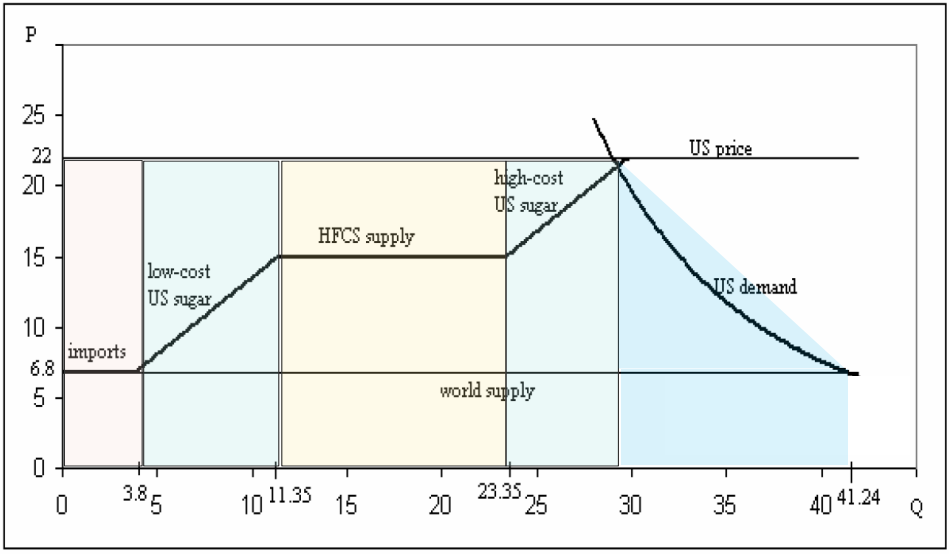
- Composed of two pieces:

1. Transfer from consumers to producers: Rectangular area of $(\$0.22 - \$0.068) \times 29$ billion $= \$4.4$ billion. Note: partly squandered on excess production costs
2. Foregone consumption: Absent sugar program, consumers would consume 41.2 billion lbs of sugar instead of 29 billion lbs. A pure DWL. Its area is $\$5.1 - \$4.4 = 0.70$ billion

U.S. domestic sugar market: Supply and demand



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Δ Producer Surplus	$0.58 bil	$1.0 bil	$0.84 bil	$ 0	
Δ Consumer Surplus	-$0.58 bil	-2.0 bil	-$1.82 bil	-0.70 bil	
DWL	0	$1.0 bil	$0.98 bil	$0.70 bil	

* Calculated at price of $0.068/lb

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Quantity (Billions Lbs)	3.8 bil	13.2 bil	12.0 bil	12.24 bil	41.24 bil
Δ Expenditure	$0.84 bil	$2.9 bil	$2.64 bil	[$0.83 bil]	$ 6.38 bil
Δ Producer Costs	$0.26 bil	$1.9 bil	$1.80 bil	[$0.83 bil]	$ 3.96 bil
Δ Producer Surplus	$0.58 bil	$1.0 bil	$0.84 bil	$ 0	$ 2.42 bil
Δ Consumer Surplus	-$0.58 bil	-2.0 bil	-$1.82 bil	-0.70 bil	$ 5.10 bil
DWL	0	$1.0 bil	$0.98 bil	$0.70 bil	$ 2.68 bil

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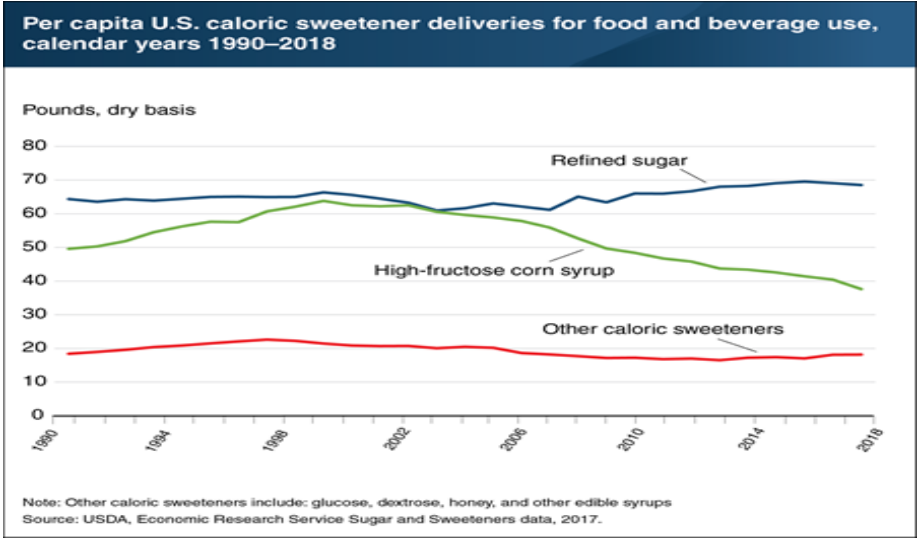
Current per capita caloric sweetener consumption in the US



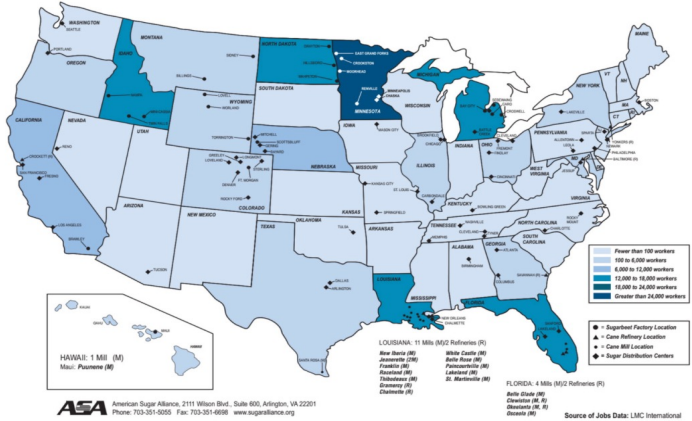
The American Sugar Alliance Has Good News for You!

American food manufacturers pay about the same for sugar today as they did in the 1980s.

Consumers in foreign countries pay, on average, 20% more for sugar than grocery shoppers in the US.

Sugar is produced in 22 states and supports 142,000 jobs nationwide.

Sugar generates $20 billion a year in economic activity across the U.S.



"What Sugar Means to Your State"

ASA American Sugar Alliance, 2111 Wilson Blvd., Suite 600, Arlington, VA 22201
Phone: 703-351-5055 Fax: 703-351-6698 www.sugaralliance.org

Quotations from "Sugar is Not Expensive"

by Ray Van Driessche, USA Today, May 23, 2000

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- U.S. retail sugar prices are not only low but also *remarkably stable*, having risen only 1% during the 1990s
- These low, stable sugar prices have been achieved at *no cost to the taxpayer since 1985 and no payments to sugar growers whatsoever*