Taxes and Subsidies on Farm Commodities and Food Products: Useful Weapons in the War on Obesity?

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Outline

1. Rationale for Policy Intervention
2. In-Principle Arguments
3. Model and Evidence
4. Conclusion
Motivation—Farm Bill Topics

- **U.S. Obesity is Expensive – a sufficient condition for policy?**
  - High Rates (~ 1/3 of adult Americans have BMI > 30)
  - Adds to health-care costs and other costs
    - $150 b (9.1% of direct medical costs) – Finkelstein et al. (2010)
    - $260 b (or $500 b including value of lost life) – Dor et al. (2010)
  - Pooling => market failure?

Motivation—Farm Bill Topics

- **U.S. Obesity is Expensive – a sufficient condition for policy?**
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- **Proposed Policies**
  - Restrict food stamps to “healthy foods”
  - Greater purchasing power of food stamps for “healthy foods”
  - Eliminate farm program subsidies
  - Revise balance of R&D spending
  - Taxes on foods (sodas), nutrients (fat), or ingredients (corn, sugar)
Market Failure Rationale for Intervention

John Freebairn. “Taxation and Obesity”

- Deficient information
  - Food consumption, other behaviour => obesity?
  - Obesity => health?

Taxes??
Market Failure Rationale for Intervention

John Freebairn. “Taxation and Obesity”  

- Deficient information
  - Food consumption, other behaviour => obesity?  
  - Obesity => health?

- Time inconsistency as market failure
  - Paternalism

- External costs of obesity (MSC = MPC + MEC > MSB)
  - Pooling of health-care costs through insurance or public provision
  - Deadweight costs of taxation to pay for public programs
  - Tax share of foregone earnings
  - Spillover costs to other family members
Model of Obesity Externality

Food

Model of Obesity Externality

Obesity

MSC
MEC
MPC
MSB

Price

Q*
Q
Quantity

P*
P
P'
P

Q*
Q
Quantity
Model of Obesity Externality

Price
MSC
MEC
MPC
MSB

Obesity

Q* Q
Quantity

P*
P
P'
P

MPC
MSC
MEC

Q*
Q
Quantity

OPTIMAL POLICY?
Model of Obesity Externality

**OPTIMAL POLICY?**

**PIGOVIAN TAX ON OBESITY?**

**CAP AND TRADE?**
Model of Obesity Externality and Food Tax

![Graphs showing the model of obesity externality and food tax.](image)

- **Obesity**
  - Price vs. Quantity graph
  - **MSC**
  - **MEC**
  - **MPC**
  - **MSB**
  - Points: \( P^* \), \( P \), \( P' \), \( Q^* \), \( Q \)

- **Food**
  - Price vs. Quantity graph
  - **S = MSC**
  - **D = MSB**
  - Points: \( P^* \), \( Q^* \)

Welfare Loss:
- Point \( P-t \) indicating welfare loss due to tax.
Model of Obesity Externality and Food Tax

**Obesity**

- Price: MSC, MPC, MPC', P*, P, P'
- Quantity: Q*, Q', Q

**Food**

- Price: MSC, S = MSC, MPC', P, P*, P - t
- Quantity: Q, Q*, Q

Welfare Loss

MSC, MSB, P*, P, P - t
A Food Tax with Heterogeneous Consumers

**Obese Group**

- Price: \( P^* \)
- MPC
- MSC
- MSB
- Quantity: \( Q^* \)

**Other Group**

- Price: \( P^* \)
- MSC = MPC
- MSB
- Quantity: \( Q^* \)

A Food Tax with Heterogeneous Consumers

**Obese Group**

- Price: \( P^* \)
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- MSC
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- Quantity: \( Q^* \)

**Other Group**

- Price: \( P^* \)
- MSB
- MSC = MPC
- Quantity: \( Q^* \)
A Food Tax with Heterogeneous Consumers

Price	Obese Group	Other Group
P* P' P
 MSC MPC MSB
 Q* Q' Q
 Q Q*

Weight Outcomes

U.S. Food Sector –Proposed Obesity Policies

Food Consumption

Food At Home	Food Away From Home	Alcoholic Beverages

Food Manufacturers, Distributors, Retailers, Wholesalers

Fruits & Vegetables	Other Crops	Meat Animals

Twinkie Taxes

Specialty Crop Programs	Farm Subsidy Programs
Linkages Between the Farm and Retail

Marketing inputs

Cereals and bakery → Meats and eggs → Dairy → F&V → Other food → Non-alcoholic drinks → FAFH → Alcohol

Grains → Meat animals → Milk → F&V → Oilseeds → Sugar → Other food crops
A Model of the Linkage Between Markets for Farm Commodities and Retail Food Products

Okrent (2010), Okrent and Alston (2011)

10 Consumer Demand Equations for Retail Products

\[ d \ln Q^n = \sum_{k=1}^{10} \eta^{n,k} d \ln P^n_k + \sum_{k=1}^{10} \eta^{n,k} t_k + \alpha^n \]

- Exogenous demand shifter
- Tax on retail products
- Producer price of retail products
- Own-and cross Marshallian elasticities of demand
- Retail quantity demanded
12 Commodity Supply Equations

\[ d \ln X_m = \sum_{j=1}^{L} \epsilon_{m,j} d \ln W_{D,j} + \sum_{j=1}^{L} \epsilon_{m,j} s_j + \beta_m. \]

- **Quantity of commodity supplied**
- **Elasticity of supply of commodities**
- **Buyer price of commodities**
- **Commodity subsidy rate**
- **Exogenous commodity supply shifter**

10 Zero Profit Equations, i.e., \( P=MC \)

\[ d \ln P_{S,R} = \sum_{l=1}^{12} SR_{l}^{D} d \ln W_{D,l} \]

- **Producer price of retail F&V**
- **Cost share of retail product attributable to a commodity**
- **Buyer price of a commodity**
12 Commodity Demand Equations

\[
d \ln X_{\text{FRUIT}} = \sum_{m=1}^{12} \eta_{\text{FRUIT},m}^* d \ln W_{D,m} + \sum_{n=1}^{10} S_{\text{FRUIT}}^{\text{nt}} d \ln Q^n
\]

- Quantity of fruit commodity demanded
- Quantity of retail product
- Cost share of fruit commodity attributable to a retail product
- Buyer prices of commodities
- Own- and cross-price Hicksian elasticities of demand for commodities

Data for Simulations
Data for Model

- Marshallian elasticities of demand for food products
  Okrent and Alston (2011)

- Farm-retail product shares
  2002 Benchmark I-O Use Table, Bureau of Economic Analysis

- Farm-commodity shares
  2002 Benchmark I-O Use Table, Bureau of Economic Analysis

Elasticities of supply of commodities
(a) $\varepsilon_{ll} = \infty$, for all $l = 1, ..., L$;  
(b) $\varepsilon_{ll} < \infty$ from Chavas and Cox (1995)

Hicksian elasticities of demand for commodities
$\eta_{ll}^* = 0$, for all $l = 1, ..., L$

Other Data

- $\%\Delta Q \rightarrow \Delta kcal$
  Average pounds and calories of foods consumed
  (2005-2006 NHANES, CDC)

- $\%\Delta Q$, $\%\Delta P$, $\%\Delta X$, $\%\Delta W \rightarrow \Delta$compensating variation, 
  $\Delta$profit, $\Delta$government revenue

  Total value of retail products and commodities (2002 
  Benchmark I-O Use Table, BEA)
Simulations and Results

Taxes Simulated

<table>
<thead>
<tr>
<th>Product Category</th>
<th>$5.00 per kilogram fat</th>
<th>$0.17 per 1000 calories</th>
<th>$6.50 per kilogram sugar</th>
<th>5% on all food products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals and bakery</td>
<td>4.66</td>
<td>6.18</td>
<td>7.93</td>
<td>5.00</td>
</tr>
<tr>
<td>Red meats</td>
<td>2.84</td>
<td>1.58</td>
<td>0.09</td>
<td>5.00</td>
</tr>
<tr>
<td>Poultry and eggs</td>
<td>3.91</td>
<td>2.30</td>
<td>0.32</td>
<td>5.00</td>
</tr>
<tr>
<td>Fish and seafood</td>
<td>2.09</td>
<td>1.91</td>
<td>0.09</td>
<td>5.00</td>
</tr>
<tr>
<td>Dairy</td>
<td>9.63</td>
<td>6.89</td>
<td>17.25</td>
<td>5.00</td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>1.52</td>
<td>2.94</td>
<td>10.05</td>
<td>5.00</td>
</tr>
<tr>
<td>Other food</td>
<td>7.85</td>
<td>5.23</td>
<td>5.63</td>
<td>5.00</td>
</tr>
<tr>
<td>Nonalcoholic beverages</td>
<td>0.91</td>
<td>3.92</td>
<td>22.18</td>
<td>5.00</td>
</tr>
<tr>
<td>FAFH</td>
<td>4.63</td>
<td>3.69</td>
<td>4.40</td>
<td>5.00</td>
</tr>
<tr>
<td>Alcoholic beverages</td>
<td>0.02</td>
<td>1.26</td>
<td>0.35</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*percentage tax rate*
### Welfare Effects of Taxes (excl. changes in public health care costs)

<table>
<thead>
<tr>
<th>Exogenous Prices of Commodities ($\varepsilon=\infty$)</th>
<th>Change in Body Weight Per U.S. Adult</th>
<th>Change in Social Welfare</th>
<th>Cost of Reduction in Individual Body Weight</th>
<th>Cost of Reduction in National Body Weight</th>
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<tr>
<td>$0.17$ tax per $1,000$ calories</td>
<td>$-5.79$</td>
<td>- $511$</td>
<td>$0.40$</td>
<td>$88$</td>
</tr>
<tr>
<td>$5.00$ tax per kilogram fat</td>
<td>$-5.81$</td>
<td>- $661$</td>
<td>$0.52$</td>
<td>$114$</td>
</tr>
<tr>
<td>$6.50$ tax per kilogram sugar</td>
<td>$-6.08$</td>
<td>- $831$</td>
<td>$0.63$</td>
<td>$137$</td>
</tr>
<tr>
<td>$5%$ tax on food products</td>
<td>$-6.04$</td>
<td>- $1,129$</td>
<td>$0.86$</td>
<td>$187$</td>
</tr>
</tbody>
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<tr>
<th>Upward-sloping Supply of Commodities ($\varepsilon&lt;\infty$)</th>
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<tr>
<td>$0.17$ tax per $1,000$ calories</td>
<td>$-5.48$</td>
<td>- $480$</td>
<td>$0.40$</td>
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<td>$5.00$ tax per kilogram fat</td>
<td>$-5.52$</td>
<td>- $598$</td>
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<td>$108$</td>
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<td>$0.82$</td>
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*Source: Okrent (2010), Okrent and Alston (2011)*

### Additional Health Care Costs

- One unit increase in BMI $\Rightarrow$ $11$ increase in billed charges for health care services over 18 months for Minnesotans 40 years of age and older (Pronk et al. 1999)

- Actual cost is greater than billed cost according to a cost-to-charge ratio $= 0.597$ for Minnesotans in 1994 (Haddix and Schaffer 1996)

- In our policy experiments the implied savings in external health care costs savings ranged from $606$ to $672$ million per year

- This translates to external cost savings of about $0.51$ per pound reduction in body weight
### Welfare Effects of Taxes (incl. changes in public health care costs)

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<td>-110</td>
<td>0.09</td>
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<tr>
<td>$5%$ tax on food products</td>
<td>-5.83</td>
<td>-397</td>
<td>0.31</td>
</tr>
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*Source: Okrent (2010), Okrent and Alston (2011)*

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**Live-weight loss?**

**Dead-weight gain!**
Caveats

- Our specific findings depend on our particular parameterization of the demand system and other elements.
- We do not consider all potential external costs associated with obesity and the estimates we use are fairly crude.
- We do not consider all potential external costs associated with particular foods or ingredients (e.g., fat or sugar).
- We do not consider distributional implications (regressive taxes) or other unintended consequences of taxes (e.g., for nutrition outcomes and health of the poor).
- But our central results are consistent with theory—more targeted policies are more efficient—and generally plausible.

The End

- Thank You!