NAFTA Renegotiation: Issues Related to Sweetener Trade and Economic Surplus

Prithviraj Lakkakula and Tom Wahl
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Prithviraj Lakkakula\textsuperscript{1} & Tom Wahl\textsuperscript{1}

\textsuperscript{1}Agribusiness and Applied Economics
North Dakota State University

2017 IATRC Annual Meetings
Washington DC
December 5, 2017
Sweetener Trade

Source: http://frucery.com/product/sugar/

Source: http://nutritioncpr.com/sitecontent/2013/02/21/high-fructose-com-syrup-ose-is-gross/
Sweetener Trade

Introduction

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Prithviraj Lakkakula & Tom Wahl (North Dakota State University)
May 16, 2017

90-day Consultation Period between USTR and Congress.

Officially August 16, 2017: the NAFTA Renegotiations have began.

Two Objectives:
1) Issues related to sweeteners that may crop up during NAFTA Renegotiations,
2) Theoretical Equilibrium Displacement Trade Model that show the changes in economic surplus in the United States and Mexico during NAFTA transition period and beyond.
Highlights potential issues of sweetener trade in NAFTA renegotiation.

Provides the context for the complexities and disputes involved in the North American sweetener market because of competing interests of the sugar associations and corn refiners association in the United States and Mexico.
Potential Issues in NAFTA Renegotiation

- Potential Issues:
  1. Raw versus Refined Sugar Imports
  2. Sweetener Trade Balance
  3. U.S. Total Fructose and Corn Exports to Mexico
Percent of U.S. Refined Sugar Imports from Mexico

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>0.3</td>
</tr>
<tr>
<td>2000</td>
<td>33.4</td>
</tr>
<tr>
<td>2005</td>
<td>57.5</td>
</tr>
<tr>
<td>2010</td>
<td>68.6</td>
</tr>
<tr>
<td>2015</td>
<td>83.5</td>
</tr>
</tbody>
</table>
Introduction

Sweetener Trade Balance/Imbalance

Introduction

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Total U.S. Fructose Exports to Mexico

<table>
<thead>
<tr>
<th>Year</th>
<th>Thousand Metric Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>148</td>
</tr>
<tr>
<td>2005</td>
<td>158</td>
</tr>
<tr>
<td>2010</td>
<td>1352</td>
</tr>
<tr>
<td>2015</td>
<td>1347</td>
</tr>
</tbody>
</table>

**Graph:**
- **Total Fructose Exports**
  - Mexico
  - Total

**Note:**
Prithviraj Lakkakula & Tom Wahl (North Dakota State University)

**Presentation Title:** NAFTA Renegotiation: Issues Related to Sweetener Trade and Economic Surplus

**Details:**
- 2017 IATRC Annual Meetings Washington DC
- Slide 9/15
Important Takeaways

1. Sweetener Trade between US and Mexico is a Tit-for-Tat strategy.

2. If the US is successful in restricting sugar imports from Mexico, then Mexico will try to block HFCS imports coming from US.
Equilibrium Displacement Model of Trade

Supply:

\[ Q_{iS}^{S/H} = f_i(P_{iS}^{S/H}) \]
(4 Equations)

Demand:

\[ Q_{iD}^{S/H} = g_i(P_i^S, P_i^H) \]
(4 equations)

Change in Stocks:

\[ I_i^S = h_i(Q_{iD}^S, P_i^S) \]
(2 equations)

Price:

\[ P_{US}^S = P_{MEX}^S (1 + AT_S) \]
\[ P_{MEX}^H = P_{US}^H (1 + AT_H) \]

Market Clearing Equations:

\[ \sum Q_{iS}^S = \sum Q_{jS}^D \]
\[ \sum Q_{iH}^S = \sum Q_{jH}^D \]
Supply:

\[
\frac{dQ_i^S}{Q_i^S} = \frac{\partial f_i(\cdot)}{\partial P_i} \cdot \frac{P_i^S}{Q_i^S} \cdot dP_i^S = \varepsilon_i \cdot \frac{dP_i^S}{P_i^S} \\
E_{Q_i^S/H} = \varepsilon_i \cdot E_{P_i^S/H}
\]

Demand:

\[
E_{Q_i^S} = \eta_{ii} E_{P_i^S} + \eta_{ij} E_{P_i^H}
\]

Change in Stocks:

\[
EI_1^S = k_1 E_{Q_{1D}^S} + k_2 E_{P_1^S}
\]

Price:

\[
E_{P_{US}^S} = E_{P_{MEX}^S} + \frac{AT_S}{(1 + AT_S)} E_{AT_S} \\
E_{P_{MEX}^H} = E_{P_{US}^H} + \frac{AT_H}{(1 + AT_H)} E_{AT_H}
\]

Market Clearing Equations:

\[
\frac{Q_{1S}^S}{\sum Q_{jS}^S} E_{Q_{1S}^S} + \frac{Q_{2S}^S}{\sum Q_{jS}^S} E_{Q_{2S}^S} = \frac{Q_{1D}^S}{\sum Q_{jD}^S} E_{Q_{1D}^S} + \frac{Q_{2D}^S}{\sum Q_{jD}^S} E_{Q_{2D}^S}
\]

\[
\frac{Q_{1S}^H}{\sum Q_{jS}^H} E_{Q_{1S}^H} + \frac{Q_{2S}^H}{\sum Q_{jS}^H} E_{Q_{2S}^H} = \frac{Q_{1D}^H}{\sum Q_{jD}^H} E_{Q_{1D}^H} + \frac{Q_{2D}^H}{\sum Q_{jD}^H} E_{Q_{2D}^H}
\]
Subscripts 1 and 2 indicate the United States and Mexico, respectively.

Superscripts S and H indicate sugar and HFCS, respectively.

ε is supply elasticity, η is the demand elasticity of the United States, δ is the demand elasticity of Mexico.

k₁, and k₂ are stock use elasticities w.r.t to consumption and price in case of the United States, while k₃, and k₄ are stock use elasticities w.r.t to consumption and price for Mexico.
Welfare Measures

Source: Gardner (1987), and Wohlgenant (2012).

\[
\Delta CS_1^S = -P_{1,0}^S \times Q_{1,0}^S (EP_1^S + 0.5(\eta_{SS} EP_1^S EP_1^S + \eta_{SH} EP_1^S EP_1^H))
\]

\[
\Delta PS_1^S = P_{1,0}^S \times Q_{1,0}^S \times EP_1^S (1 + 0.5 \times EQ_1^S)
\]
Thank You