Analyzing Vertical Market Structure and Its Implications for Trade Liberalization*

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* Draws on 2004 IATRC Working Paper, Sexton, Sheldon, McCorriston, and Wang
Introduction

Doha Round of WTO is a “development round”, focus on increasing LDC access to DC markets

Little attention paid to food marketing system in DCs in analyzing commodity exports of LDCs:

- Vertical/horizontal structure
- Increasing consolidation

Who captures the benefits of tariff reduction when downstream markets are imperfectly competitive?
Globalization and Market Access

- Increasing concentration of global food system harms LDC exporters of commodities, e.g., coffee (Oxfam, 2001)

- LDCs will not benefit from globalization, e.g., Mozambique exports of raw cashew nuts (McMillan, et al., 2002)

- Unease over increased international corporate control – calls for global competition policy (Clarke and Evenett, 2003)
Structure of Food Marketing in Developed Countries

- Food manufacturing concentrated in US and EU, e.g., average 3-firm concentration of 67% in EU

- Food retailing concentrated at national level in EU, and at regional and local level in US

- Increasing consolidation via mergers and acquisitions

- Structure of successive oligopoly/oligopsony
Trade Liberalization and Industry Consolidation in a Vertically-Related Market

- If markets were competitive, ignoring vertical market structure would not matter

- Only recently have models examining optimal trade policy included imperfect competition (Ishikawa and Spencer, 1999)

- With imperfect competition, incidence of benefits of trade liberalization is important (Figure 1)

- Increasing consolidation in food marketing also affects share of value added received by LDC exporters (Figure 2)
Figure 1: Trade Liberalization and the Vertical Marketing Chain
Figure 2: Increased Concentration in the Vertical Marketing Chain
Trade Liberalization and Market Structure

- Use vertical market model to simulate trade liberalization (Sexton and Zhang, 2001)
- Fixed proportions, constant returns technology in processing and retailing
- Linear farm supply and consumer demand
- Competition at processing/retailing levels captured through conjectural elasticity approach
A Model When Downstream Firms May Exercise Market Power

(1) \( P_r = D(Q_r, X) \), Importing country excess demand

(2) \( P_f = S(Q_f, Y) \), Exporting country excess supply

- Assume fixed proportions in processing and retailing, in which case, through choice of measurement units we can set \( Q^r = Q^w = Q^f = Q \)

- Assume CRS in both processing and retailing functions

- Assume processing and retailing firms are identical

(3) \( C^w = c^w (V^w)q^f + (P^f + T)q^f \), Processor cost function

(4) \( C^r = c^r(V^r)q^w + P^wq^w \), Retailer cost function
Marketers may have both oligopsony and oligopoly power

- Given model structure, results are identical regardless of whether a given degree of market power is exercised by processors or by retailers

- For convenience assume processor market power and retailer perfect competition, the retail price being $P^r = P^w + c^r$

\[(5) \quad \pi^w = (D(Q^r) - c^r)q - S(Q^f)q - (c^w + T)q \quad \text{Processor profit function}\]
Processor Optimization Condition

\[
(6) \quad P^w \left(1 - \frac{\xi^w}{\eta^w_1}\right) = P^f \left(1 + \frac{\theta^f}{\epsilon^f}\right) + (c^w + T),
\]

\[\epsilon^f = \frac{\partial Q^f}{\partial P^f} \frac{P^f}{Q^f}\]

is the market price elasticity of supply of the farm product,

\[\eta^w = -\frac{\partial Q^w}{\partial P^w} \frac{P^w}{Q^w}\]

is the market price elasticity of derived demand for the processed product

\[\theta^f = \frac{\partial Q^f}{\partial q} \frac{q}{Q^f}, \ [0,1]\]

measures the processing firm’s degree of oligopsony market power in procuring the farm product

\[\xi^w = \frac{\partial Q^w}{\partial q} \frac{q}{Q^w}\], \ [0,1]

measures the processing firm’s degree of oligopoly power in selling the processed product.

\[C^w = \text{per-unit processing costs}\]

\[T = \text{per-unit tariff}\]
Market Power at Successive Market Stages

- Successive oligopoly power: processors exercise oligopoly power over retailers, and retailers exercise oligopoly power over consumers. Processors may also exercise oligopsony power over producers.

\[
P^r \left(1 - \frac{\xi^r}{\eta^r}\right) = P^w + c^r. \quad \text{Retailer optimization condition}
\]

\[
P^w \left(1 - \frac{\xi^w}{\eta^w}\right) = P^f \left(1 + \frac{\theta^f}{\xi^r}\right) + (c^w + T), \quad \text{Processor optimization condition.}
\]

- Three market power parameters: \(\xi^r, \xi^w,\) and \(\theta^f\)
Market Power at Successive Market Stages

- Successive oligopsony power: processors exercise oligopsony power over producers, retailers exercise oligosonory power over processors, and retailers may exercise oligopoly power over consumers.

\[
P^w = P^f \left(1 + \frac{\theta^f}{\xi^r} \right) + (c^w + T). \quad \text{(Processor optimization condition)}
\]

\[
P^r \left(1 - \frac{\xi^r}{\eta^r} \right) = P^w \left(1 + \frac{\theta^w}{\xi^w} \right) + c^r. \quad \text{(Retailer optimization condition)}
\]

- Three market parameters are now: \( \xi^r, \theta^w, \) and \( \theta^f \)
Linear Simulation Model

(1') \( Q^r = a - \alpha P^r \), importing country excess demand at retail,

(2') \( P^f = b + \beta Q^f \), exporting country inverse farm excess supply.

- At no further loss of generality, make full use of range of normalizations available by setting retail price and output equal to 1.0 at no-tariff competitive equilibrium

\[
P^r = 1
\]

\[
P^f = 1 - c^r - c^w = f
\]

farm revenue share in perfect competition

\[
Q^r = Q^w = Q^f = 1.0
\]

perfect competition output

\[
\alpha = \eta^r, \quad \beta = \frac{f}{\xi^r}, \quad a = 1 + \alpha, \quad b = f - \beta,
\]

(2'') \( P^f + T = b + \beta Q^f + T \). Introduction of a tariff shifts farm excess supply
Figure 3: Processor Oligopoly and Oligopsony Power

\[
\theta^i MC^i + (1 - \theta^i)P^f + c^w + T
\]

\[
\phi^f + c^w + T
\]

\[
P^f(Q)
\]

\[
P^r(Q)
\]

\[
P^w = P^r - c^r
\]

\[
\xi^w MR^w + (1 - \xi^w)P^w
\]
Figure 4: Successive Oligopoly Power with Processor Oligopsony Power

\[ \theta^f MC^f + (1 - \theta^f)P^f + c^w + T \]

\[ P^f + c^w + T \]

\[ P^f(Q) \]

\[ P^r(Q) \]

\[ P^r - c^r \]

\[ P^w = PMR^r - c^r \]

\[ \xi^w MR^w + (1 - \xi^w)P^w \]
Figure 5: Successive Oligopsony Power with Retailer Oligopoly Power

\[ \theta^w MC^w + (1 - \theta^w)P^w \]

\[ \theta^f MC^f + (1 - \theta^f)P^f + c^w + T \]

\[ P^f + c^w + T \]

\[ P^f(Q) \]

\[ P^r(Q) \]

\[ P^r - c^r \]

\[ P^w = PMR^r - c^r \]
Model Calibration

- Key market power parameters are $\xi_r$, $\xi_w$, $\theta_f$, and $\theta_w$ – as these lie in range 0 to 1, simulate over entire unit interval

- Consider equal departures from competition, e.g., in case of successive oligopsony and retailer oligopoly, $\theta_f = \theta_w = \xi_r$

- Farm share of revenue under no tariff competitive equilibrium set at $f = 0.5$ – when $f$ is small, diminishes impact of oligopsony

- Per-unit tariff at competitive equilibrium set at $T=0.2$

- Price elasticity of farm supply and retail demand evaluated at no-tariff competitive equilibrium, $\varepsilon^f_c = \eta^r_c = 1$, which, given $f = 0.5$, implies that $\varepsilon^w_c = 2.0$
### Estimated Market Power and Lerner Indices

<table>
<thead>
<tr>
<th>Study</th>
<th>Industry</th>
<th>Market Power</th>
<th>Lerner Index</th>
</tr>
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<tbody>
<tr>
<td><strong>Appelbaum (1982)</strong></td>
<td>US textiles</td>
<td>0.05</td>
<td>0.07</td>
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<td></td>
<td>US tobacco</td>
<td>0.40</td>
<td>0.65</td>
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<td><strong>Lopez (1984)</strong></td>
<td>Canadian food processing</td>
<td>0.19</td>
<td>0.50</td>
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<td><strong>Schroeter (1988)</strong></td>
<td>US beef-packing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- oligopsony</td>
<td>0.22</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>- oligopoly</td>
<td>0.07</td>
<td>0.04</td>
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<tr>
<td><strong>Karp and Perloff (1989)</strong></td>
<td>Rice export</td>
<td>0.68</td>
<td>0.11</td>
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<tr>
<td><strong>Azzam and Pagoulatos (1990)</strong></td>
<td>US meat (oligopoly)</td>
<td>0.22</td>
<td>0.46</td>
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<tr>
<td></td>
<td>US livestock (oligopsony)</td>
<td>0.18</td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>US composite meat processing</td>
<td>0.04</td>
<td>0.74</td>
</tr>
<tr>
<td><strong>Schroeter and Azzam (1990)</strong></td>
<td>US beef oligopoly</td>
<td>0.05</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>US pork</td>
<td>0.06</td>
<td>0.47</td>
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<td><strong>Buschena and Perloff (1991)</strong></td>
<td>Philippines coconut oil</td>
<td>0.58</td>
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<td><strong>Wann and Sexton (1992)</strong></td>
<td>US grade pack pears</td>
<td>0.08</td>
<td>0.15</td>
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<td></td>
<td>US fruit cocktail</td>
<td>0.48</td>
<td>1.41</td>
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<td><strong>Deodhar and Sheldon (1995)</strong></td>
<td>German bananas</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Deodhar and Sheldon (1996)</strong></td>
<td>German bananas</td>
<td>0.20</td>
<td>0.18</td>
</tr>
<tr>
<td><strong>Bhuyan and Lopez (1997)</strong></td>
<td>US food industries</td>
<td>0.18</td>
<td>0.33</td>
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<tr>
<td></td>
<td>US tobacco industries</td>
<td>0.18</td>
<td>0.33</td>
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<td><strong>Wilson (1997)</strong></td>
<td>UK bread manufacturing</td>
<td>0.31</td>
<td>0.84</td>
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<td><strong>Genoseve and Mullin (1998)</strong></td>
<td>US sugar industry</td>
<td>0.04</td>
<td>0.05</td>
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<td><strong>Steen and Salvanes (1999)</strong></td>
<td>French fresh salmon</td>
<td>0.02-0.05</td>
<td>0.12-0.04</td>
</tr>
<tr>
<td><strong>Bettendorf and Verboven (2000)</strong></td>
<td>Dutch coffee roasting</td>
<td>0.02-0.17</td>
<td>0.07-0.54</td>
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<tr>
<td><strong>Gohin and Guyomard (2000)</strong></td>
<td>French food retailing:</td>
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<td></td>
<td>- dairy products</td>
<td>-0.02</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>- meat products</td>
<td>-0.03</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>- other food products</td>
<td>0.01</td>
<td>0.12</td>
</tr>
</tbody>
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Figure 6: Effect of Market Power on Producer Welfare

Figure 4: The Effect of Market Power on Producer Welfare

Market Power Index

Producer Surplus Change (%)

Oligopsony
Oligopoly
Oligopsony and oligopoly
Successive Oligopsony with Oligopoly
Successive Oligopoly with Oligopsony

Market Power Index

Producer Surplus Change (%)
Figure 7: Effect of Market Power on Total Welfare

-100  -80  -60  -40  -20  0
Market Power Index

-100  -80  -60  -40  -20  0  0.2  0.4  0.6  0.8  1
Total Welfare Change (%)

Oligopsony
Oligopoly
Oligopsony & Oligopoly
Successive Oligopsony with Oligopoly
Successive Oligopoly with Oligopsony
Figure 8: Effect of Market Power on Distribution of Welfare: Processor Oligopsony and Retail Oligopoly
Figure 9: Change in Farm Price from Trade Liberalization

Market Power Index vs. Farm Price Change for different market structures:
- Oligopsony
- Oligopoly
- Oligopsony & Oligopoly
- Successive Oligopsony with Oligopoly
- Successive Oligopoly with Oligopsony
Figure 10: Change in Producer Surplus from Trade Liberalization

![Graph showing the change in producer surplus from trade liberalization across different market power index. The graph compares oligopsony, oligopoly, and various combinations of oligopsony and oligopoly.](image)
Figure 11: Change in Producer Surplus, Consumer Surplus and Marketers’ Profits from Trade Liberalization for Case of Processor Oligopsony and Retail Oligopoly
Figure 12: Change in Producer Surplus, Consumer Surplus and Marketers’ Profits from Trade Liberalization for Case of Successive Oligopoly with Processor Oligopsony
What does analysis miss?

- Domestic farm sector ignored in DCs
- Tariffs are usually *ad valorem*
- Explicit analysis of tariff escalation
- Rich nature of vertical structures, e.g., vertical restraints
Conclusions

- Structure of food marketing system in DCs matters for who gains from trade liberalization.

- Increasing consolidation in food marketing system may reduce share of consumer’s “food dollar” going to LDC exporters.

- LDC exporters may gain as much from vertical integration into value-adding activities as from trade liberalization.