Chinese and U.S. Apple Trade in ASEAN

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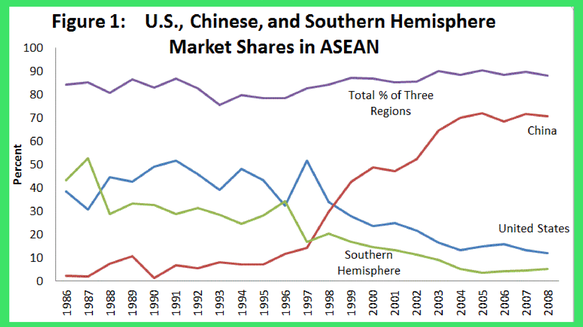
Background

ASEAN Apple Market

- The Association of Southeast Asian Nations (ASEAN) countries import all the apples because the tropical climate is not conducive for apple production.
- Due to economic reforms and steady economic growth, apple imports by ASEAN countries have increased by 517% since 1990, while world apple trade has increased only by 102%.
- The United States supplied between 30 - 50% of the ASEAN market until 1996 when Chinese exporters became dominant. By 2004, the market share for U.S. apple exports dropped to about 14%, whereas the Chinese market share jumped to about 70% (Figure 1).

Figure 1: U.S., Chinese, and Southern Hemisphere Market Shares in ASEAN



- ASEAN imposes tariff of 5.1 - 11% on apple imports.
- ASEAN-China Free Trade Agreement phases out tariff barriers on Chinese apples by 2015.

U.S. and Chinese Apple Markets

Both the United States and China provide subsidies for apple production. U.S. apples are of higher quality than Chinese apples. Market concentration in both countries leads to potential market power.

Subsidies

- The United States offered market-loss payment of $262 million because of stagnant production, domestic sales, and exports in the 1980s and 1990s and lower prices in the late 1990s.
- In 1984, China relinquished state control of apple orchards and provided a 2 million Yuan seedling subsidy. Starting in 1994, China also offered apple bagging and other production subsidies.

Quality

- Due to better crop management practices in the United States relative to China, U.S. exporters supply high quality apples to ASEAN, while Chinese exporters compete with low-quality apples.
- McCracken et al. (1991) show that southeast Asian wholesalers consider U.S. apples to be high quality and value apple branding by origin.

Market concentration

- According to McCracken et al. (1991), 88% of Washington State apple producers use intermediary firms for exporting apples.
- According to U.S. International Trade Commission (2011), Chinese apple producers sell their apple to intermediary traders, who sells apples to a specialized supply firm, leading to consolidation.

Objectives

1.Investigate market power in both domestic and ASEAN markets.

2.Analyze the impacts of domestic and trade policies on U.S., Chinese, and ASEAN apple markets.

These objectives are accomplished by

1.Developing a theoretical model under imperfect competition in differentiated products and obtaining analytical results.

2.Implement the theoretical model through econometric estimation and simulation analysis.

Theoretical Model

- Profit Function: $\pi^i = \frac{\hat{p}^i(y^i, y^j)}{1+\tau^i} y^i + p^i(x^i)x^i - c^i(x^i + \frac{y^i}{g^i}) - F^i + s^i[x^i + \frac{y^i}{g^i}]$

where *i,j=U.S.* and *China*, $\hat{p}^i(\bullet)$ is the ASEAN inverse demand for U.S. or Chinese apples, τ^i is the ad valorem tariff imposed by ASEAN, y^i is the sales of U.S. or Chinese apples in ASEAN, $p^i(\bullet)$ is the domestic inverse demand function for apples, x^i is the domestic sales of apples, $c^i(\bullet)$ is the cost of production, s^i is a government subsidy, F^i is a fixed cost, and is g^i the iceberg transport cost.

- First Order Conditions/Reaction Functions for the export and domestic market:

$$\text{Exp: } \hat{p}^i = \frac{1+\tau^i}{g^i}\left(\frac{\partial c(\bullet)}{\partial y^i} - s^i\right) + \hat{p}^i(e_{p^i,y^i}\theta^i_{y^i,y^i} + e_{p^i,y^j}\Theta^i_{y^i,y^j}) \qquad \text{Dom: } p^i = \frac{\partial c(\bullet)}{\partial x^i} - s^i + p^i e_{p^i,x^i}\theta^i_x$$

where e_{p^i,x^i}, e_{p^i,y^i}, and e_{p^i,y^j} are domestic, export, and cross-demand flexibilities and $\theta^i_x, \theta^i_{y^i,y^i}$, and $\Theta^i_{y^i,y^j}$ are domestic, regional, and cross-regional conjectural elasticities.

- Analytical Results: $\frac{dy^i}{d\tau^i} < 0 \quad \frac{dy^j}{d\tau^i} > 0 \quad \frac{dy^i}{ds^i} > 0 \quad \frac{dy^j}{ds^i} < 0 \quad \frac{dy^i}{dg^i} > 0 \quad \frac{dy^j}{dg^i} < 0.$

Empirical Model

Nonlinear 3SLS is used to estimate a system of 8 equations and 8 variables

D. Function: $\text{Exp: } \hat{p}^i = a^i_0 + a^i_1 y^i + a^i_2 y^i z + a^i_3 y^j + a^i_4 y^j z + a^i_5 z + a^i_6 y^S + \varepsilon^i_{ed}$

$\text{Dom: } p^i = \beta^i_0 + \beta^i_1 x^i + \beta^i_2 x^i v^i + \beta^i_3 v^i + \varepsilon^i_{dd}$

S. Relations: $\text{Exp: } p^i = \frac{1+t^i}{g^i}(\eta^i_0 + \eta^i_1 u^i + \eta^i_2(x^i + \frac{y^i}{g^i}) - s^i) + \theta^i_{y^i,y^i} y^{i*} + \Theta^i_{y^i,y^j} y^{j*} + \varepsilon^i_{es}$

where $y^{i*} = -(a^i_1 + a^i_2 z)y^i$ and $y^{j*} = -(a^i_3 + a^i_4 z)y^j$

$\text{Dom: } p^i = \eta^i_0 + \eta^i_1 u^i + \eta^i_2(x^i + \frac{y^i}{g^i}) - s^i + \theta^i_x x^{i*} + \varepsilon^i_{ds}$

where $x^{i*} = -(\beta^i_1 + \beta^i_2 v^i)x^i$

We define a structural drift variable to capture the change in market shares between 1996 and 2004 (Figure 1).

$$\theta^i_{y^i,y^i} = \theta^{ia}_{y^i,y^i} + \theta^{ib}_{y^i,y^i} B(t) \text{ and } \Theta^i_{y^i,y^j} = \Theta^{ia}_{y^i,y^j} + \Theta^{ib}_{y^i,y^j} B(t), \text{where } B(t) = \frac{t-t_0}{t_f - t_0} I_{(t_0,t_f]}(t) + I_{(t_f,t_N]}(t)$$

Variable Definitions

z is exogenous demand shifters for ASEAN.

y^S is exports from the southern hemisphere, takes as exogenous.

v^i is exogenous demand shifters for the U.S. and China.

u^i is a vector of inputs price in the marginal cost function.

$B(t)$ is a structural drift variable.

$I_{(\cdot)}(t)$ is an indicator function.

Data: 1986-2008

Endogenous variables: Food and Agricultural Organization and International Labour Organization.
Exogenous variables: World Bank, Food and Agricultural Organization, USDA NASS, China Stat Year Book.
Policy Variables: World Trade Organization and USDA FAS.

Econometric Results

Export Market

Variable/Coeff.	United States	China
Export Supply Relations		
intercept	0.1265 (1.28)	0.1185 (4.80***)
$TG^i * inputp^i$	——	0.0063 (6.32***)
$TG^i*(inputp^i)^{1/2}$	0.0710 (5.93***)	——
$TG^i*(y^i/g^i+x^i)$	0.0002 (5.82***)	6.84e-6 (2.58**)
$\theta^{ia}_{y^i,y^i}$	0.5861 (2.08**)	0.0000 (.)
$\theta^{ib}_{y^i,y^i}$	-0.5859 (2.07**)	0.4536 (3.43**)
$\Theta^{ia}_{y^i,y^j}$	0.0000 (.)	0.4653 (2.34***)
$\Theta^{ib}_{y^i,y^j}$	0.0000 (.)	0.5346 (2.68***)
Export Demand Relationship		
intercept	3.0894 (12.05***)	0.8320 (9.33***)
y^j	-0.0152 (-2.33**)	-0.0026 (-3.68***)
$y^j * z^A$	0.0001 (2.26**)	0.00001 (2.23**)
y^j	-0.0036 (-1.15)	-0.0004 (-0.30*)
$y^j * z^A$	-5.95e-6 (-0.25)	0.00002 (1.82*)
y^S	-0.0173 (-3.92***)	-0.0024 (-1.63)
z^A	0.0008 (0.53)	0.0005 (0.92)

Domestic Market

Variable/Coeff.	United States	China
Domestic Supply Relations		
intercept	0.1265 (1.28)	0.1185 (4.80***)
$Inputp^i$	——	0.0063 (6.32***)
$(inputp^i)^{1/2}$	0.0710 (5.93***)	——
(y^i/g^i+x^i)	0.0002 (5.82***)	6.84e-6 (2.58**)
$\theta^i_{x^i}$	0.0000 (.)	0.0848 (0.64)
Domestic Demand Relationship		
intercept	4.1465 (2.18**)	0.8764 (10.71***)
x^i	-0.0015 (-1.79*)	-9.19e-6 (-1.42)
$x^i * v^A$	-4.56e-7 (-1.48)	6.48e-8 (4.92***)
v^i	0.0017 (1.47)	0.0005 (2.24**)

***,**,* Significant at the 1, 5, 10 % level

Additional Variable Definitions

inputp = input price index

TG = tariff divided by the iceberg cost: $(1+\tau^i)/g^i$

Export Market

- U.S. and Chinese conjectural elasticities range between zero and one.
- U.S. exporters did not influence Chinese exports.

Domestic Market

- U.S. conjectural elasticity is zero, implying no market power.
- Chinese conjectural elasticity is small at 0.085, and is statistically insignificant.

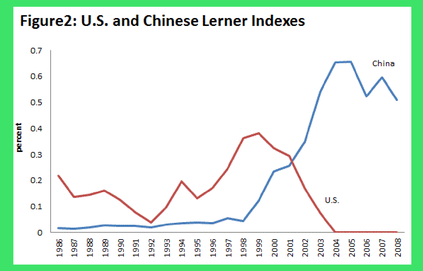
Lerner Indexes

From the first-order conditions:

$$\text{Export: } \frac{p^i - \frac{1+\tau^i}{g^i} mc^i_y}{p^i} = e_{p^i,y^i}\theta^i_{y^i,y^i} + e_{p^i,y^j}\Theta^i_{y^i,y^j}$$

$$\text{Domestic: } \frac{p^i - mc^i_x}{p^i} = e_{p^i,x^i}\theta^i_{x^i}$$

Figure2: U.S. and Chinese Lerner Indexes



Implications

- US market power in ASEAN increased between 1992 and 1999 and decreased there after reaching zero by 2004 (Figure 2).
- Chinese market power in ASEAN increased dramatically after 1998 when the Chinese market share rose, and reached a peak of 0.66 by 2005 (Figure 2).
- The Lerner Index is zero in the U.S. domestic market, implying competitive pricing. This is because $\theta^{US}_{x^{US}} = 0$.
- The Lerner Index in the Chinese domestic market averages 0.048, but the conjectural elasticity is not statistically different from zero.

Simulation Results

Tariff

- China-ASEAN free trade agreement expands Chinese exports by 13.81% and contracts U.S. Exports by 19.24%.
- As a result, the higher Chinese exports cause the Chinese apple price in ASEAN to decline by 11.68% and the lower U.S. exports cause the U.S. apple price to increase by 1.46%.

Transport Cost

- Increasing transport cost has a smaller negative impact on Chinese exports than on U.S. exports because of China's close proximity to ASEAN.
- A 10% increase in transport cost reduces Chinese exports by 30.93%, whereas a similar increase in transport cost contracts U.S. exports by 37.35%.

Subsidy

- A 10% increase in Chinese subsidy augments Chinese export and domestic sales by 42.82% and 30.91%, respectively. The increase in Chinese exports to ASEAN lowers U.S. exports by 57.31%.
- A similar increase in U.S. subsidy augments U.S. exports and domestic sales by 18.59% and 9.02%. The increase in U.S. exports to ASEAN reduces Chinese export by 10.84%.
- Chinese subsidy augments China's welfare by $47.3 million and lowers the U.S. welfare by $5.3 million. U.S. subsidy raises U.S. welfare by $13.3 million and reduces Chinese welfare only by $4.1 million.
- Domestic subsidies drive out the competition and increase the welfare to the detriment of competing counting countries.

Conclusions

- U.S. apple producers use exporting firms to sell apples in ASEAN. This leads to market concentration and exporters mark prices above marginal cost. In the U.S. domestic market, perfect competition prevails.
- In China, because apples change hands several times before they are exported, market consolidation occurs in the ASEAN markets. Therefore, Chinese export exert market power in ASEAN. In the Chinese domestic market, market power is small and statistically insignificant.
- China-ASEAN free trade agreement favors Chinese exports and harms U.S. exports.
- Transport cost has a larger negative impact on U.S. exports than on Chinese exports.
- Chinese subsidy has a larger adverse impact on U.S. Exports and Welfare than U.S. subsidy has on Chinese exports and welfare.