

Imperfect Competition between Florida and São Paulo (Brazil) Juice Producers in the U.S. and European Markets

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Background

U.S. and European Markets

Frozen concentrated orange juice (FCOJ) production for the U.S. and European (EU) markets is highly concentrated both geographically and economically.

Geographically

- Florida and São Paulo (state in Brazil) orange juice processors control an average of 89% of the U.S. market.
- São Paulo processors supply an average of 84% of the European market.



Economically

- Florida: 16 processors in 2010.
- São Paulo: 4 firms produced 85% of the total Brazilian supply in 2005.

The high concentration of processors in Florida and São Paulo makes it conducive for these processors to exercise market power by engaging in oligopolistic competition.

U.S. and European FCOJ Tariffs

U.S. and European orange juice markets are protected by tariffs

United States

- Applied specific tariff per SSE (single strength equivalent) gallon in 2000 is \$0.2971.

Europe

- Applied ad valorem tariff in 2000 is 15.2%.



The Free Trade Area of the Americas threatens to reduce or eliminate the tariff on FCOJ entering the United States from South American producers, which will increase competition.

Objectives

- Develop a strategic trade model to assess the existence and level of oligopolistic competition between Florida and São Paulo processors.
- Derive analytical results to theoretically examine the effects of changes in the U.S. and European tariffs on the FCOJ market in the United States and Europe.
- Specify and estimate an econometric model based on the strategic trade model and compute the degree of market power exerted by Florida and São Paulo FCOJ processors.
- Simulate the effects of exogenous changes in the U.S. and European tariff on prices, production, and sales in both the U.S. and European FCOJ markets.

Strategic Trade Model

Florida's and São Paulo's Profit Functions

$$\pi^f = p^u(q^u)q^f - C^f(q^f) - F^f$$

$$\pi^s = \frac{p^u(q^u)}{(1+\tau^u)}q^{su} + \frac{p^e(q^{se})}{(1+\tau^e)}q^{se} - C^s\left(\frac{q^{su}}{g^u} + \frac{q^{se}}{g^e}\right) - F^s$$

First-Order Conditions (Reaction Functions)

$$p^u = \frac{\partial C^f(\bullet)}{\partial q^u} + \theta^f \varepsilon^u p^u$$

$$p^u = (1+\tau^u) \frac{\partial C^s(\bullet)}{\partial q^{su}} + \theta^{su} \varepsilon^u p^u$$

$$p^e = (1+\tau^e) \frac{\partial C^s(\bullet)}{\partial q^{se}} + \theta^{se} \varepsilon^e p^e$$

Variables

p^i ($i = u, e$) is the U.S. and EU price, $p^i(\bullet)$ is the demand, q^j ($j = u, f, su, se$) is quantity for U.S., by Florida in U.S., by São Paulo in U.S., and by São Paulo in the EU, $C^i(\bullet)$ is the total cost, F^i is the fixed cost, τ^i is the tariff, and g^i is the iceberg transport cost.

$\partial C^i(\bullet) / \partial q^j$ ($i = f, s; j = u, su, se$) are Florida's and São Paulo's marginal cost functions, θ^i ($i = f, su, se$) is Florida's market power in U.S. and São Paulo's market power parameter in the U.S. and EU, and ε^i ($i = u, e$) is the U.S. and EU price flexibilities of demand.

Comparative Statics

Totally differentiate the reaction functions and apply Cramer's Rule to obtain the results for

A change in the U.S. tariff: $\frac{dq^{su}}{d\tau^u} < 0$, $\frac{dq^{se}}{d\tau^u} > 0$, and $\frac{dq^f}{d\tau^u} > 0$

A reduction in the U.S. tariff increases the price of São Paulo's FCOJ exports in the U.S. market. As a result, exports from São Paulo to the United States increase at the expense of their exports to Europe.

A change in the European tariff: $\frac{dq^{se}}{d\tau^e} < 0$, $\frac{dq^{su}}{d\tau^e} > 0$, and $\frac{dq^f}{d\tau^e} > 0$

A decrease in the European tariff increases the price of São Paulo's FCOJ exports in Europe. Thus, São Paulo processors divert their exports from the U.S. to EU. As exports from São Paulo to the United States decrease, Florida's FCOJ production and sales increases.

Econometric Model

Econometric specification for demand and supply relations are derived from the reaction functions.

$$\text{Demand Functions: } p^i = \alpha_0^i + \alpha_1^i q^i + \gamma^i z^i, \quad i, j = u, e$$

$$\text{Supply Relations: } p^u = \beta_0^f + \beta_1^f q^f + \beta^f x^f + \theta^f \alpha_1^u q^u$$

$$p^i = \frac{(1+\tau^i)}{g^i} \left(\beta_0^{si} + \beta_1^{si} \left(\frac{q^{si}}{g^i} + \frac{q^{sj}}{g^j} \right) + \beta^{si} x^s \right) + \theta^{si} \alpha^i q^i$$

$$\text{Equilibrium Conditions: } q^u = q^f + q^{su} + q^o$$

$$q^e = q^{se}$$

Nonlinear 2SLS is used to estimate the system of 7 equations.

Variable Definitions

z^j are exogenous demand shifters for the U.S. and EU

x^k $k=f,s$ is a vector of inputs price in the marginal cost function.

q^o is the U.S. supply not from Florida or São Paulo

Data

Period: 1986-2009

Endogenous variables: USDA ERS, Florida Department of Citrus, USDL BLS.

Exogenous variables: Wade (2001), USDA FAS, UN FAO, and World Bank.

Policy Variables: World Trade Organization and US Census Bureau.



Econometric Results

Supply Relation Estimation For Florida

| Variable/Coefficients | Florida |
|--------------------------------|---------------|
| intercept ^f | 1.10 (0.482) |
| q ^f | 1.29 (0.008) |
| (q ^f) ² | -0.12 (0.008) |
| inputp ^f | 3.93 (0.201) |
| prop ^u | 0.005 (0.002) |
| trend | -0.06 (0.007) |
| θ ^f | 0.72 (0.019) |

Supply Relation Estimation For Sao Paulo

| Variable/Coefficients | Exp to U.S. (i = su) | Exp to Eu. (i = se) |
|--------------------------------------|----------------------|---------------------|
| intercept | 2.80 (0.089) | 0.88 (0.030) |
| (q ^{su} + q ^{se}) | 0.01 (0.876) | 0.02 (0.737) |
| inputp ^s | 123.58 (0.018) | 8.59 (0.474) |
| (inputp ^s) ² | -1706.71 (0.008) | -48.84 (0.489) |
| (inputp ^s) ³ | 6831.12 (0.007) | — |
| trend | -0.04 (0.019) | -0.23 (0.156) |
| tcost ⁱ | 1.35 (0.000) | 0.67 (0.000) |
| D2 | — | -0.49 (0.000) |
| θ ⁱ | 1.07 (0.002) | 1.06 (0.184) |

Exogenous Variables

inputpⁱ: aggregate input cost
 tcostⁱ: transportation cost
 propⁱ: producer price
 D1: 1 for 2008-2009, 0 otherwise
 D2: 1 for 2004-2009, 0 otherwise
 Popⁱ: population
 RIncⁱ: real income
 cqⁱ: cross-quantity grapefruit juice

Demand Estimation For U.S. and EU

| Variable/Coefficients | United States (i = u) | Europe (i = e) |
|---------------------------------|-----------------------|----------------|
| intercept | 18.45 (0.000) | 25.40 (0.000) |
| q ^u | -0.21 (0.000) | — |
| q ^e | — | -0.08 (0.001) |
| Pop ⁱ | -5.24 (0.001) | -8.85 (0.000) |
| RInc ⁱ | 0.03 (0.129) | 0.06 (0.005) |
| cq ⁱ | -1.88 (0.215) | -3.98 (0.107) |
| (cq ⁱ) ² | 0.83 (0.219) | — |
| D1 * RInc ⁱ | 0.01 (0.001) | 0.005 (0.073) |

US FCOJ Market

- Florida's and São Paulo's conjectural elasticities are 0.72 and 1.07.

- São Paulo has a greater market power than Florida.

EU FCOJ Market

- São Paulo's conjectural elasticity is 1.06.

*numbers in parentheses are p-values

Lerner Indexes

$$Fl.: \frac{p^u - \partial C^f / \partial q^f}{p^u} = \theta^f \varepsilon^u = 0.72 * 0.48 = 0.35$$

$$S.P. US.: \frac{p^u - (1+\tau^u) \partial C^s / \partial q^{su}}{p^u} = \theta^{su} \varepsilon^u = 1.07 * 0.48 = 0.51$$

$$S.P. EU.: \frac{p^e - (1+\tau^e) \partial C^s / \partial q^{se}}{p^e} = \theta^{se} \varepsilon^e = 1.06 * 0.80 = 0.84$$

Both Florida and São Paulo earn oligopolistic rents, and São Paulo processors exert greater market power than Florida processors in the U.S. market

Simulation Results

- A 25% U.S. tariff reduction results in an 8% reduction in Florida's market share and a 27% increase in São Paulo's market share in the U.S. FCOJ market.
- A 25% European tariff reduction results in Florida's U.S. market share to increase by 2% and São Paulo's U.S. market share to reduce by 6%.
- Both the U.S. and European tariff reductions result in a 6% decline in Florida's U.S. market share while São Paulo's U.S. market share increases by 20%.

Conclusions

- The states of Florida and São Paulo are dominant in the U.S. FCOJ market, and São Paulo is dominant in the European FCOJ market.
- Both Florida and São Paulo exert market power earning oligopolistic rents in the U.S. FCOJ market, and São Paulo earns oligopolistic rents in the EU also.
- Because of higher concentration and lower production costs, São Paulo processors exert more market power in the U.S. market than Florida processors.
- The U.S. tariff reduction will favor São Paulo producers and adversely impact Florida processors, but benefit U.S. consumers.