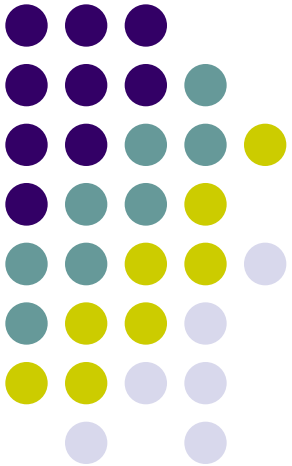
An Assessment of the Global Soybean Industry: An Application of Stochastic Equilibrium Displacement Model

Rafael de F. Costa, Yan Xia, & Parr Rosson
Center for North American Studies (CNAS)
Dept. of Agricultural Economics
Texas A&M University



http://cnas.tamu.edu

Objective

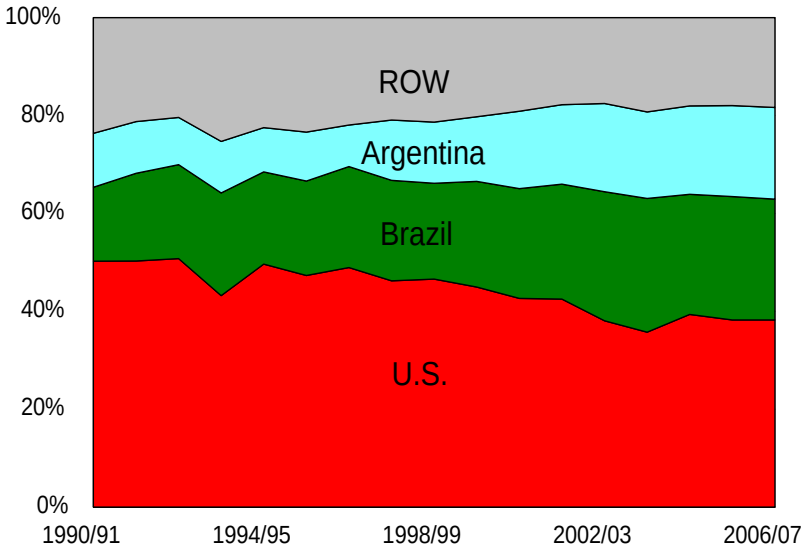
- Analyze and Quantify the Impact of Reduction in Transportation Costs in Brazil and LDP in U.S. on the World Soybean and its Joint Products with Alternative Scenarios.

Overview

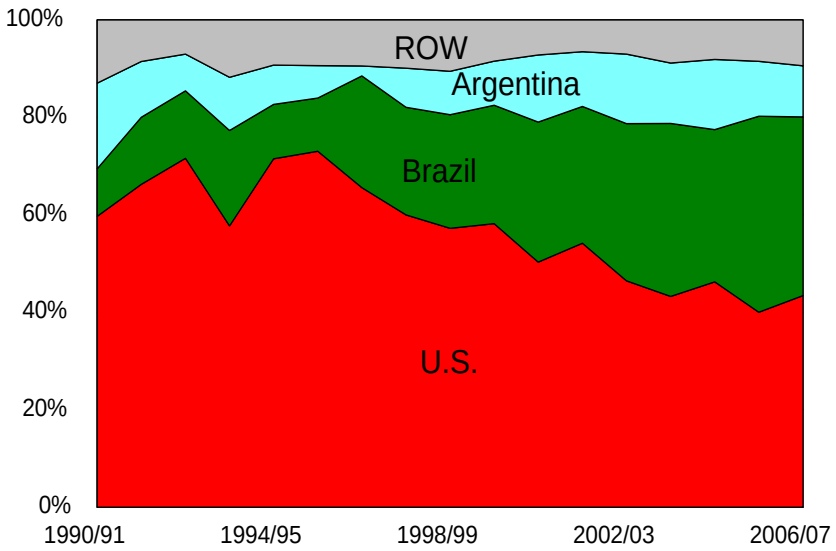
- World Soybean Industry Market and Barriers to Free Trade
  - World Soybean Production and Exports
  - Barriers to Free Trade
- Methodology
- Scenarios and Results
- Conclusions

World Soybean Industry

World Soybean Production (1990/91 - 2006/07)



World Soybean Exports (1990/91 - 2006/07)

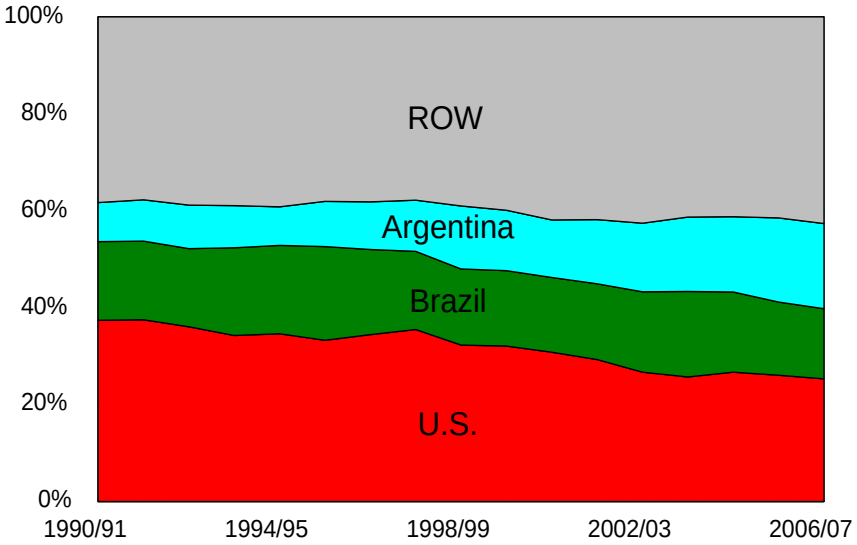


Source: PS&D, FAS/USDA

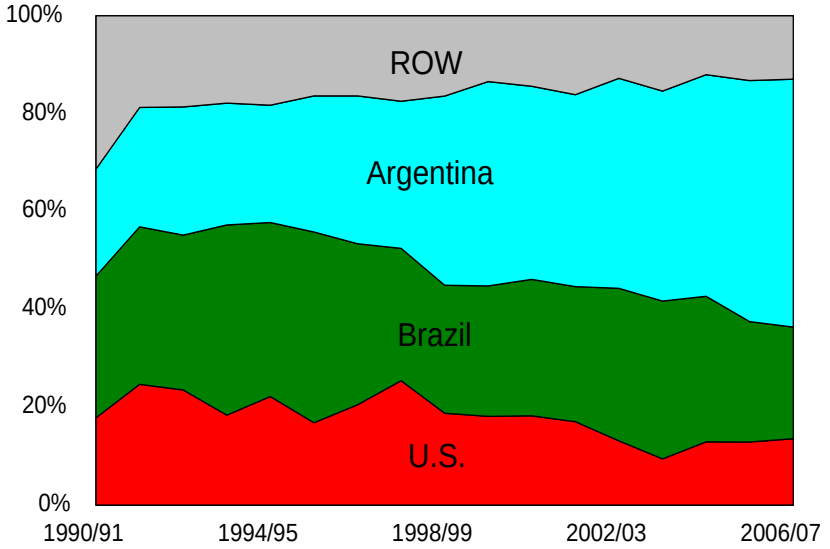
CENTER FOR NORTH AMERICAN STUDIES
CNAS
http://cnas.tamu.edu

World Soybean Industry

World Soybean Joint Products Production (1990/91 - 2006/07)



World Soybean Joint Products Exports (1990/91 - 2006/07)



Source: PS&D, FAS/USDA

CENTER FOR NORTH AMERICAN STUDIES
CNAS
http://cnas.tamu.edu

Export Cost Competitiveness

Cost Item	U.S. Heartland	Brazil		Argentina
		Mato Grosso	Paraná	
Variable costs:	US$ per acre			
Seed	28.67	12.79	10.54	18.57
Fertilizers	7.73	47.00	22.22	6.26
Chemicals	17.10	35.47	38.61	17.56
Machine Operation Repair	22.13	18.02	22.82	21.36
Interest on Capital	1.00	7.38	5.32	9.87
Hired Labor	1.26	1.46	5.59	6.08
Harvest	n/a	5.52	8.22	12.49
Miscellaneous	n/a	1.57	2.02	n/a
Total variable costs	**77.88**	**129.21**	**115.35**	**92.21**
Fixed Costs:				
Depreciation of machinery/equipment	51.36	16.83	18.96	22.14
Land costs (rental rate)	97.45	15.46	25.91	72.78
Taxes and insurance	5.92	2.81	4.63	n/a
Farm overhead	12.23	2.54	1.91	23.98
Total fixed Costs	**166.96**	**37.63**	**51.40**	**118.90**
Total production costs	**244.84**	**166.84**	**166.75**	**211.11**

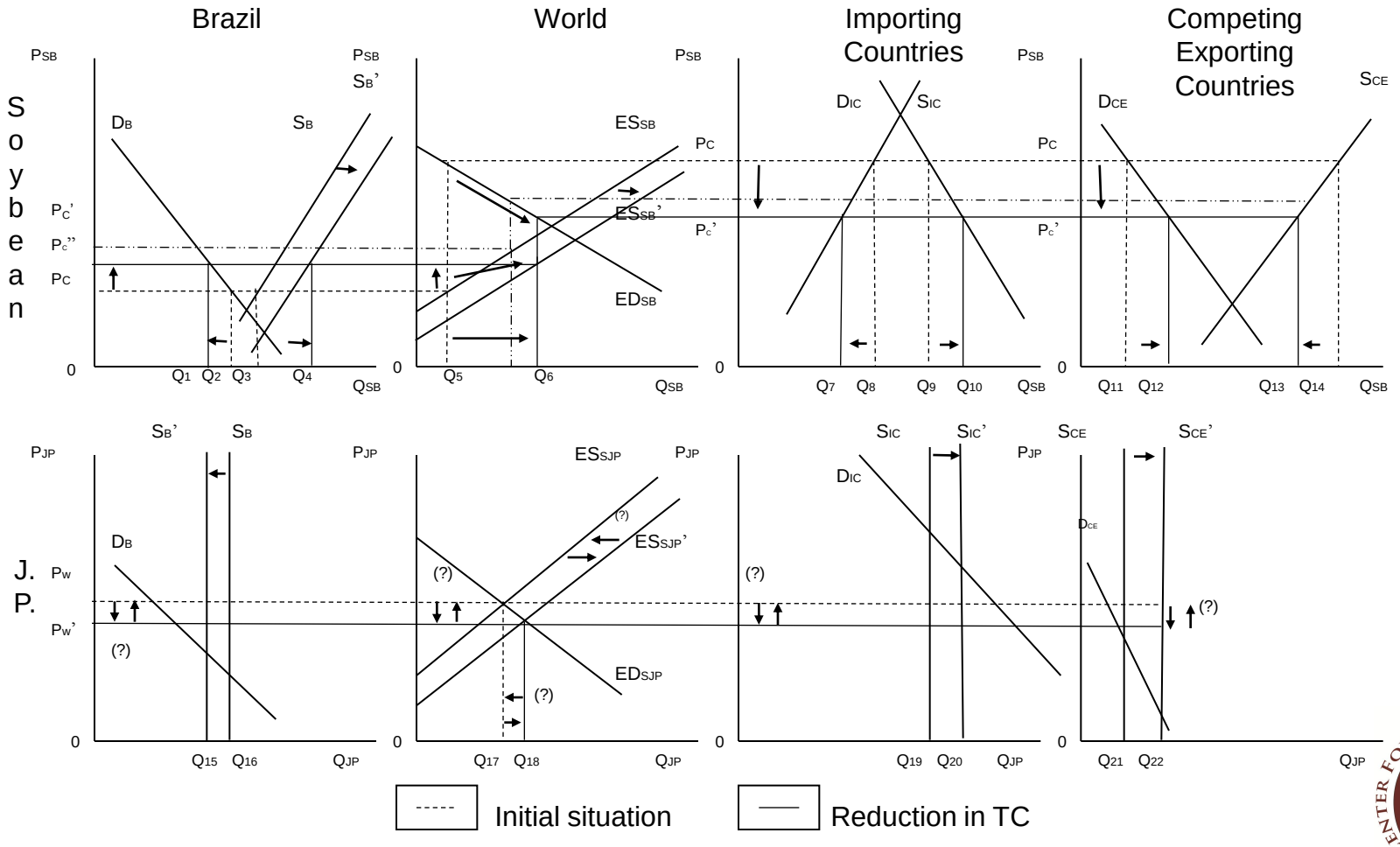
Export Cost Competitiveness (Cont.)

Costs per bushel:	*US$ per bushel (% of U.S. cost)*			
Yield (bushels/acre)	46.00	43.07	41.38	50.00
Variable costs per bushel	1.69	3.00	2.79	1.84
Fixed costs per bushel	3.63	0.87	1.24	2.38
Total costs per bushel	**5.32**	**3.87 (73)**	**4.03 (76)**	**4.22 (79)**
Internal trans. & marketing (US$/bu.)[4]	0.48	1.80	0.81	0.72
Cost at border	**5.81**	**5.67 (98)**	**4.84 (83)**	**4.94 (85)**
Freight costs to Rotterdam[5]	0.39	1.25	1.25	1.03
Price at Rotterdam	**6.20**	**6.92 (112)**	**6.09 (98)**	**5.97 (96)**

Source: ERS/USDA (2006), Schnepf et al., Rebolini (2005), Conab (2006) Paraná State Department of Agriculture (SEAB) (2006), CIF Rotterdam prices (FAS/USDA, 2006); U.S. FOB Gulf port prices (ASA, 2006); U.S. producer price (NASS/USDA, 2006); Argentinean internal transportation and marketing costs to port: Schnepf et al. and Lence; Brazil FOB prices are from Rio Grande (Safras and Mercado) and Paranagua (Reuters) (FAS/USDA, 2006).

CENTER FOR NORTH AMERICAN STUDIES CNAS http://cnas.tamu.edu

Conceptual Analysis of Transportation Costs Reduction in Brazil



U.S. Farm Program

- Direct Payment
  - Fixed
  - Decoupled from current production (ERS)
- Counter-Cyclical Payment
  - CCP rate = Target Price - (DP rate + max {loan rate, price})
  - Reduce revenue variability and risk
- Marketing loan (Loan Deficiency Payment)
  - Fixed
  - Directly coupled to current production

Methodology – Theoretical Considerations

- Model is based on the modern economic consumer and producer theory
- Nonjointness of production is assumed
- Given perfect competition, by Sheppard's lemma, output supply and input demand were:

$$P = AC(W)$$

$$X = X(W, Z)$$

where AC is average cost function, P is output price vector, W is the input price vector, X is input vector, and Z is output vector.

Methodology – Analytical Model

- Based on previous considerations, a model was developed to reflect the linkage of soybean and its joint products.

- Six country-groups: (i) exporters – U.S., Brazil, and Argentina; and (ii) importers – EU, Asia (Japan and China), and ROW.

Methodology – Analytical Model

I. Soybean joint products (soymeal and soyoil)

- Consumption

(1) $MD_j = MD_j\ (PMD_j, PMM_j)$

(2) $OD_j = OD_j\ (POD_j, POM_j)$

(3) $MM_j = MM_j\ (PMD_j, PMM_j)$

(4) $OM_j = OM_j\ (POD_j, POM_j)$

- Production

(5) $PMD_j = AC\ (PB_j, PB_i)$

(6) $POD_j = AC\ (PB_j, PB_i)$

(7) $PMS_i = AC(PB_i)$

(8) $POS_i = AC(PB_i)$

II. Soybean

- Demand

(9) $BD_i = BD_i\ (MS_i, OS_i, PB_i)$

(10) $BDM_j = BDM_j\ (MS_j, OS_j, PB_i, PB_j)$

- Supply

(11) $BS_i = BS_i\ (PB_i, a_i)$

Methodology - SEDM

- Stochastic Equilibrium Displacement Model (SEDM)
- Total Differential of Each Equation in the Model and Express them in the Form of Relative Change and Elasticities
- Data were Obtained from PS&D/FAS/USDA, CONAB (Brazil), and SAGPyA (Argentina)

Results: Scenario 1 – 15% Reduction in TC in Brazil

Exporters	*(%-change)*
Brazil Soybean Supply	(0.06,0.07)
Brazil Soymeal Supply	(0.003,0.004)
Brazil Soyoil Supply	(-0.004,-0.003)
Brazil Soybean Export Price	(-0.19,-0.17)
Brazil Soymeal Export Price	(-0.063,-0.055)
Brazil Soyoil Export Price	(-0.041,-0.036)

Importers	*(%-change)*
Asia Imp. Demand for Soybean	(0.01,0.02)
Asia Imp. Demand for Soymeal	(-0.03,-0.02)
Asia Imp. Demand for Soyoil	(-0.016,-0.014)
EU Imp. Demand for Soybean	(0.001,0.009)
EU Imp. Demand for Soymeal	(0.006,0.007)
EU Imp. Demand for Soyoil	(-0.007,-0.002)

Results: Scenario 2 – Scenario 1 plus 5% Decrease in U.S. LDP rate

Exporters	*(%-change)*
Brazil Soybean Supply	(0.06,0.07)
U.S. Soybean Supply	(-0.031,-0.005)
Brazil Soymeal Supply	(0.003,0.005)
U.S. Soymeal Supply	(-0.001,0.014)
Brazil Soyoil Supply	(-0.001,0.004)
U.S. Soyoil Supply	(0.0002,0.0034)
Brazil Soybean Export Price	(-0.19,-0.17)
U.S. Soybean Export Price	(0.042,0.146)
Brazil Soymeal Export Price	(-0.063,-0.055)
U.S. Soymeal Export Price	(0.018,0.065)
Brazil Soyoil Export Price	(-0.041,-0.036)
U.S. Soyoil Export Price	(0.01,0.04)

Importers

- No significant changes compare to previous scenario

CENTER FOR NORTH AMERICAN STUDIES
CNAS
http://cnas.tamu.edu

Conclusions

- Soybean
  - Brazil is less efficient in TC compared to U.S.
  - If TC decreases in Brazil, Brazil's soybean supply increases ⟶ soybean export price decreases
  - For the U.S., decrease in LDP rate reduces supply ⟶ export price increases
  - Asia and EU import demand increases
  - Brazil gains competitiveness
  - U.S. loses competitiveness
  - No significant changes in Argentina

Conclusions

- Soybean Joint Products
  - Regarding supply, Brazil suffers diverging results: For Scenario 1, Soymeal supply up and Soyoil supply down. In Scenario 2, both increases
  - As for export prices, decrease for both products

    ⟶ Brazil more competitive
  - U.S.'s soymeal and soyoil export prices increases, becoming less competitive
  - Asia import demand for joint products were down, but EU does not change significantly
  - Again, no significant changes in Argentina

Questions?

http://cnas.tamu.edu

Rafael de F. Costa

Ph: 979-845-7221

E-mail: rfcosta@ag.tamu.edu