

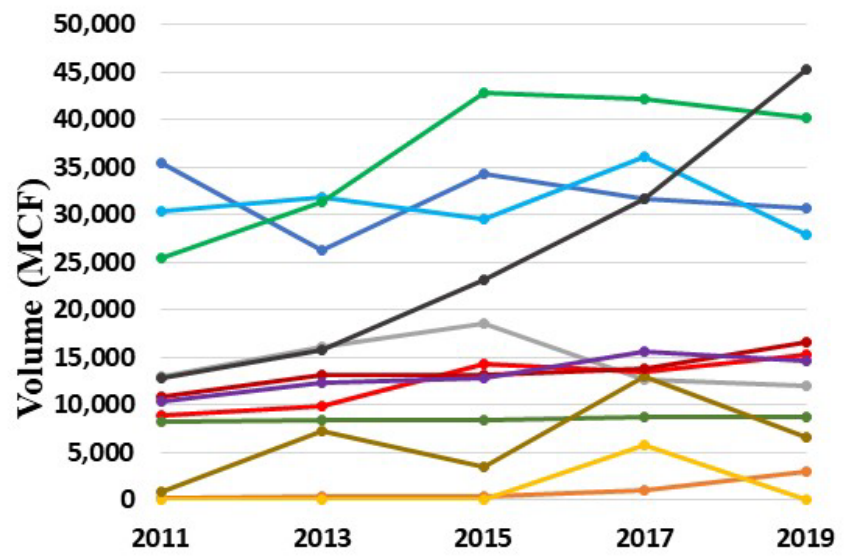
Department of Forestry & Environmental Resources

Interstate Softwood Roundwood Trade in the Southern United States: A Gravity Trade Model Approach

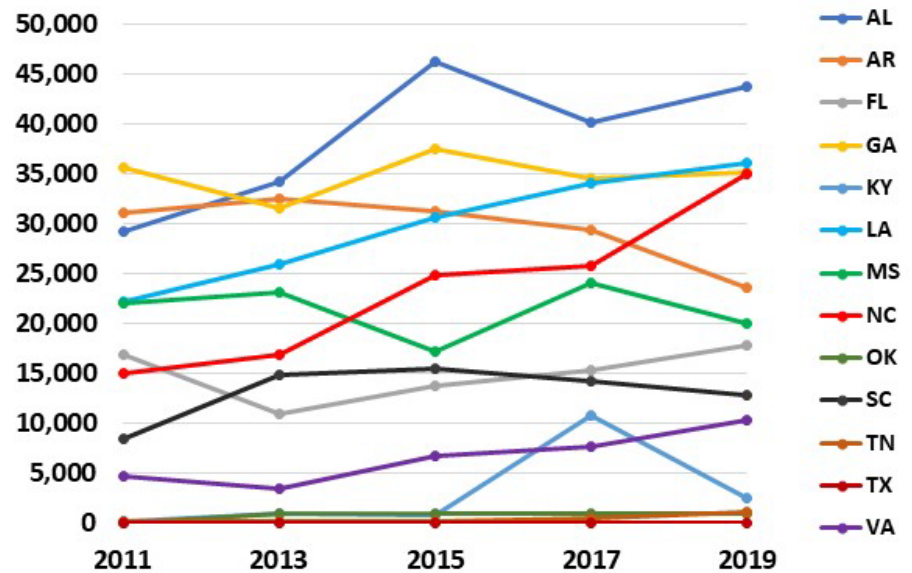
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Historical Sawlog Trade Trends

A) Exports



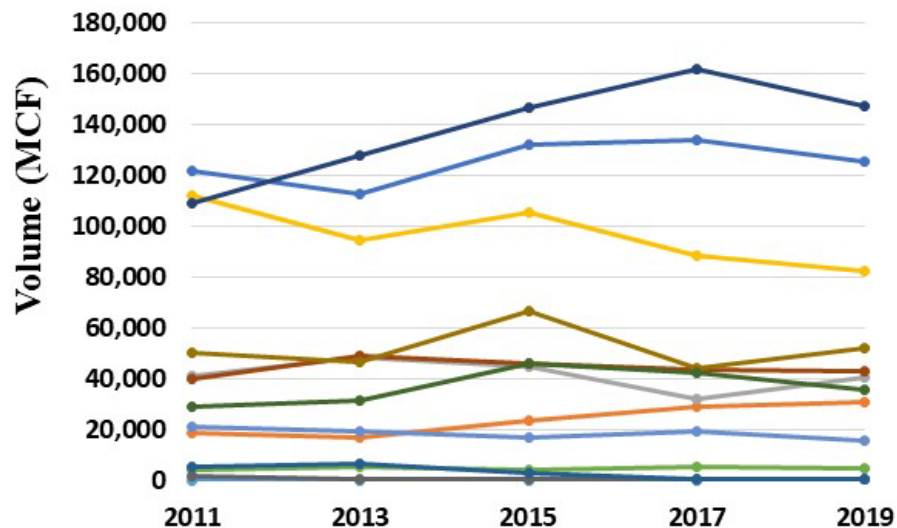
B) Imports



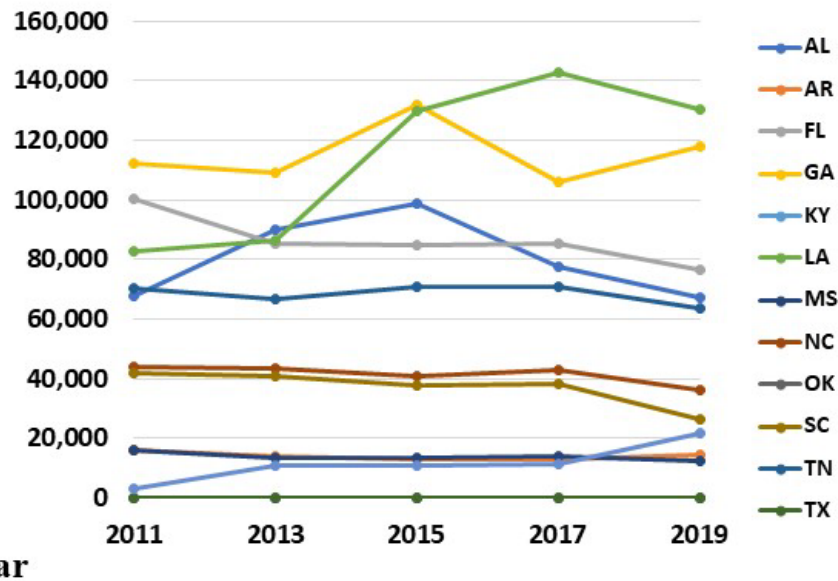
Year

Historical Pulpwood Trade Trends

A) Exports



B) Imports



Background: Why is interstate softwood roundwood trade important in the US South?

- US South is the nation's highest softwood producing region (Howard and Liang, 2019).
- In US South, 25% of pulpwood consumption by the pulp industry and 12% of sawlog consumption by sawmill industry is transported from other states in the region (Polyakov and Teeter, 2007).
- In 2019 98.2% of total trade in the US South occurred between states in the region.

Methodologies: Gravity Trade Model

- Gravity trade model is a commonly used theoretical framework to assess trade dynamic questions.
- Simply states that distance is inversely proportional to trade volume, while GDP is proportional to trade volume (Tinbergen, 1962).
- Estimation was conducted with various econometric methodologies.
 - Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), and Hausman-Taylor (HT) estimators

Results: Sawlog Models

Variable	Exports	Imports
Distance	-2.31	-5.05
Importer GDP		1.29
Importer Consumption	0.70	
Exporter(Importer) Production	0.36	0.92
Border	4.13	3.12
Importer Precipitation		2.52
Electronic Logging Mandate		-0.58

Results: Pulpwood Models

Variable	Exports	Imports
Distance	-4.57	-3.22
Importer GDP	1.64	
Exporter GDP		-1.64
Importer Consumption	0.47	
Importer Delivered Price	3.42	3.67
Exporter Delivered Price		-2.87
Border	2.98	3.97
Exporter Precipitation	-0.99	
Pellet Mill Capacity	0.17	0.15

Conclusions

- Distance negatively influences softwood roundwood trade due to transportation costs.
 - Sharing a common border increases trade due to distance, similar geographic regions, and mill procurement zones.
 - ELD (Electronic logging device) mandate reduces sawlog trade, as it relates to distance.
- GDP, production, and consumption are all influential determinants.
 - Related to demand. Increasing GDP and consumption increases demand, while increasing production increases inventories.

Conclusions

- Precipitation negatively influences exports but positively influences imports.
 - Precipitation impacts timber harvesting operations, thus in-state production and inventories.
- Delivered prices only influence pulpwood trade and not sawlog
 - End use product differentiations between pulp and sawlog roundwood.
 - Results align with marketing principles as exports search out the best markets.

Thank you!

Questions?

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Appendix: Export Models

Export	Sawlog				Pulpwood			
Coefficient	OLS	FE	RE	HT	OLS	FE	RE	HT
Distance (mi.)	-5.15*** (0.92)	-0.52 (1.67)	-4.06*** (0.93)	-2.31* (1.21)	-4.95*** (0.95)	-1.25 (3.24)	-4.57*** (0.91)	-3.28** (1.43)
Exporter GDP (chained millions 2012)	1.09** (0.54)	-0.27 (3.46)	1.19** (0.53)	1.01 (1.37)	-0.50 (0.53)	-5.86* (3.25)	-0.03 (0.52)	-0.22 (0.84)
Importer GDP (chained millions 2012)	1.01* (0.51)	-1.49 (3.39)	0.77 (0.56)	-1.70 (1.20)	1.74*** (0.54)	0.82 (3.83)	1.64*** (0.56)	0.81 (1.33)
Exporter Production (thou.cu.ft.)	0.22* (0.11)	0.50 (0.31)	0.27** (0.11)	0.36* (0.19)	0.04 (0.60)	-0.05 (0.08)	0.08 (0.06)	0.02 (0.08)
Common Border	3.15*** (0.87)	Omitted	3.79*** (0.87)	4.13*** (1.30)	2.70*** (1.01)	Omitted	2.98*** (1.01)	3.57*** (1.29)
Exporter Precipitation (in.)	-0.07 (1.03)	0.68 (1.02)	0.09 (0.77)	0.14 (0.86)	-2.74*** (0.98)	-0.59 (0.70)	-0.99* (0.55)	-0.74 (0.63)
Importer Precipitation (in.)	3.11** (1.03)	1.50 (1.22)	1.62* (0.94)	0.95 (0.98)	2.13 (1.34)	0.08 (0.62)	0.68 (.59)	-0.02 (0.66)
Exporter Delivered Price (dollars)	2.59 (2.90)	-2.88 (2.88)	0.01 (1.89)	-0.52 (1.84)	2.09 (3.98)	-1.08 (1.67)	-1.04 (1.61)	-3.21*** (1.24)
Importer Delivered Price (dollars)	3.02 (4.02)	-1.60 (2.94)	-0.54 (2.37)	0.43 (2.04)	0.25 (3.59)	4.14*** (1.66)	3.42* (1.98)	2.89* (1.60)
Importer Consumption (thous.cu.ft.)	0.57** (0.23)	0.77 (0.70)	0.75*** (0.18)	0.70*** (0.24)	0.61*** (0.06)	0.12 (0.10)	0.47*** (0.12)	0.27 (0.16)
Exporter Cum. Pellet Mill Cap. (thou.tons)	-	-	-	-	0.38*** (0.13)	0.08 (0.08)	0.17** (0.08)	0.11 (0.07)
Electronic Logging Device	-1.00** (0.46)	0.17 (0.73)	-0.46 (0.31)	0.17 (0.25)	-1.09 (0.69)	0.48 (0.80)	-0.81 (0.52)	-0.03 (0.26)
Constant	-33.50* (16.99)	19.86 (60.11)	-17.27 (14.75)	6.49 (18.40)	2.50 (15.32)	67.94 (55.44)	-3.61 (11.42)	13.36 (16.27)

Import	Sawlog				Pulpwood			
Coefficient	OLS	FE	RE	HT	OLS	FE	RE	HT
Distance (mi.)	-5.52*** (0.84)	-2.39 (1.79)	-5.05*** (0.75)	-3.50*** (1.07)	-4.79*** (0.83)	-1.38 (3.26)	-4.67*** (0.84)	-3.22** (1.52)
Importer GDP (chained millions 2012)	1.43*** (0.53)	-2.55 (3.61)	1.29** (0.54)	-1.36 (1.07)	2.28*** (0.66)	2.64 (4.81)	2.01*** (0.58)	0.50 (1.52)
Exporter GDP (chained millions 2012)	0.68 (0.48)	-0.41 (3.50)	0.69 (0.47)	.26 (0.90)	-0.32 (0.59)	-6.32* (3.24)	-0.19 (0.55)	-1.64* (0.96)
Importer Production (thou.cu.ft.)	0.82*** (0.22)	0.58 (0.56)	0.92*** (0.19)	0.72*** (0.28)	0.55*** (0.09)	0.12 (0.12)	0.38*** (0.12)	0.17 (0.15)
Common Border	2.88*** (0.78)		3.12*** (0.71)	3.36*** (0.99)	2.75*** (0.85)		3.03*** (0.93)	3.97*** (1.18)
Importer Precipitation (in.)	3.60*** (1.30)	2.10 (1.27)	2.52*** (0.97)	1.53 (0.99)	3.86*** (1.33)	0.64 (0.78)	1.32** (0.57)	0.19 (0.61)
Exporter Precipitation (in.)	0.23 (1.02)	0.35 (1.06)	0.27 (0.78)	0.08 (0.88)	-3.05** (1.20)	-0.67 (0.72)	-0.67 (0.58)	-0.81 (0.59)
Importer Delivered Price (dollars)	2.20 (3.30)	-2.08 (3.04)	-0.71 (2.22)	0.23 (2.07)	1.07 (3.93)	3.79** (1.66)	3.15 (1.97)	3.67** (1.56)
Exporter Delivered Price (dollars)	2.32 (2.90)	-3.45 (2.99)	-0.33 (1.83)	-0.86 (1.93)	2.89 (4.32)	-1.47 (1.86)	-1.29 (1.77)	-2.87** (1.32)
Exporter Consumption (thous.cu.ft.)	0.08 (0.06)	0.02 (0.07)	0.07 (0.04)	0.07 (0.05)	0.14** (0.07)	-0.20 (0.13)	0.00 (0.07)	-0.12 (0.11)
Importer Cum. Pellet Mill Cap. (thou.tons)					-0.02 (0.13)	0.17* (0.09)	0.17** (0.07)	0.15** (0.06)
Electronic Logging Device	-1.09** (0.45)	0.65 (0.81)	-0.58* (0.33)	0.37 (0.23)	-0.79 (0.74)	0.01 (0.97)	-0.94* (0.54)	0.10 (0.32)
Constant	-32.58** (16.12)	54.42 (63.31)	-13.93 (13.91)	21.09 (14.65)	-15.78 (15.21)	52.97 (61.80)	-6.09 (11.50)	33.25* (18.32)