

Network Analysis of Quota Trading in the Gulf of Mexico IFQ Fisheries

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Project Objectives

- Examine the mechanics of quota (allocation and share) trading in the GOM IFQ fisheries
- Evaluate interaction between the quota trading and dockside markets
- Examine the role of dealers in the IFQ trading market
- Examine allocation prices to see if the GOM IFQ allocation market is a single integrated market or several regional markets with different prices

Data Used

- Share, allocation, dockside landings trading data (2007-2019)
 - Buyer, seller, date, amount (lbs), price
- IFQ shareholder account ownership information (account ownership by % for each year)
- Analysis focused on arms-length transactions, shareholder accounts with the same owners were combined into a single entity
 - Stringent definition of account overlap –if Acct #1 is owned by A, B, C, and D and Acct #2 is owned by A,B, and C (no D) then they do not overlap
 - Stringent definition may classify some transactions as arms-length that are not
- IFQ dealer accounts were linked to IFQ shareholder accounts based on internet searches of dealer accounts

Networks Created

- Allocation Network: Shareholder to shareholder allocation trades
- Share Network: Shareholder to shareholder share trades
- Landings Network: Shareholders sells IFQ species dockside to dealer
- Shared Dealer Network: Shareholders connected if they sold IFQ species dockside to the same dealer
- Networks were created by year and species group (RS, SWG, DWGTF, All IFQ Species)



Allocation Pounds Traded By Dealer Affiliated Accounts

Year	% of Dealer-Affiliated Shareholder Accounts	Dealer Affiliated Buyer	Dealer Affiliated Seller
2010	10%	36%	33%
2011	11%	26%	28%
2012	13%	30%	30%
2013	13%	31%	27%
2014	15%	38%	33%
2015	15%	39%	33%
2016	14%	38%	33%
2017	14%	34%	26%
2018	14%	36%	27%
2019	16%	40%	33%

Allocation Trading Pattern Analysis

- Created different relational networks to examine trading patterns
 - Shared Dealer: Shareholders connected if they sold IFQ species dockside to the same dealer
 - Shared County: Shareholders connected if they live in the same county
 - Previous Year Trading: Shareholders connected if they traded allocation in the previous year
- We then measured the overlap between each relational network and the allocation trading network
 - For instance, if two shareholders sold fish to the same dealer and had an allocation trade the two networks were said to have overlapped

Allocation Trading Pattern Analysis

- Jaccard Index was used to measure the overlap between allocation trading and each relational network
- $JI(A, B) = \frac{|A \cap B|}{|A \cup B|}$.
- $|A \cap B|$ - Intersection of networks A and B. The intersection is all pairs of shareholders that were **connected in both networks** (allocation and relational)
- $|A \cup B|$ - Union of networks A and B. The union is all pairs of shareholders that were **connected in at least one of the networks** (allocation and relational)
- The Jaccard Index takes on a value between 0 (no overlap) and 1 (perfect overlap)
- A quadratic assignment procedure (QAP) was used to create 2,500 pairs of matrices where the connections in one of the networks was randomized and Jaccard Index values were calculated.
- The randomized Jaccard Index values were compared to the observed value to determine if these relationships impacted the frequency of allocation trading

Allocation Trading Pattern Analysis

Shared Dealer QAP Analysis			
	<u>2011</u>	<u>2015</u>	<u>2019</u>
Observed Jaccard Index	0.103***	0.099***	0.089***
Average Random Jaccard Index	0.004	0.004	0.005
Observed/Random	25.75	24.75	17.80
Shared County QAP Analysis			
	<u>2011</u>	<u>2015</u>	<u>2019</u>
Observed Jaccard Index	0.045***	0.043***	0.044***
Average Random Jaccard Index	0.006	0.006	0.006
Observed/Random	7.50	7.17	7.33
Previous Year Allocation Trade QAP Analysis			
	<u>2011</u>	<u>2015</u>	<u>2019</u>
Observed Jaccard Index	0.252***	0.318***	0.331***
Average Random Jaccard Index	0.003	0.003	0.003
Observed/Random	84.00	106.00	110.33

Fisher Behavior Relative to Dealer Communities



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
% of Total Pounds Sold to Primary Dealer	93%	94%	94%	94%	96%	96%	97%	97%	97%	95%
% of Fishers with same Primary Dealer as Previous Year	85%	85%	89%	84%	84%	86%	86%	90%	87%	84%
Fisher-to-Fisher Allocation Trades within Dealer Communities	68%	52%	59%	63%	61%	69%	63%	75%	70%	71%

Non-Fisher Trading Relative to Dealer Communities

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Avg. Number of Communities Transacted with by Non-Fishers	1.56	1.69	1.78	1.90	1.76	1.86	1.83	1.77	1.83	2.24
Avg. % of Allocation Pounds Transacted with Primary Community	93%	93%	94%	91%	91%	91%	92%	93%	93%	90%
% of Total Allocation Pounds to Primary Community	76%	72%	79%	73%	81%	84%	84%	84%	80%	80%
% of Non-Fishers with same Primary Community as Previous Year	62%	56%	65%	63%	59%	73%	73%	72%	68%	68%

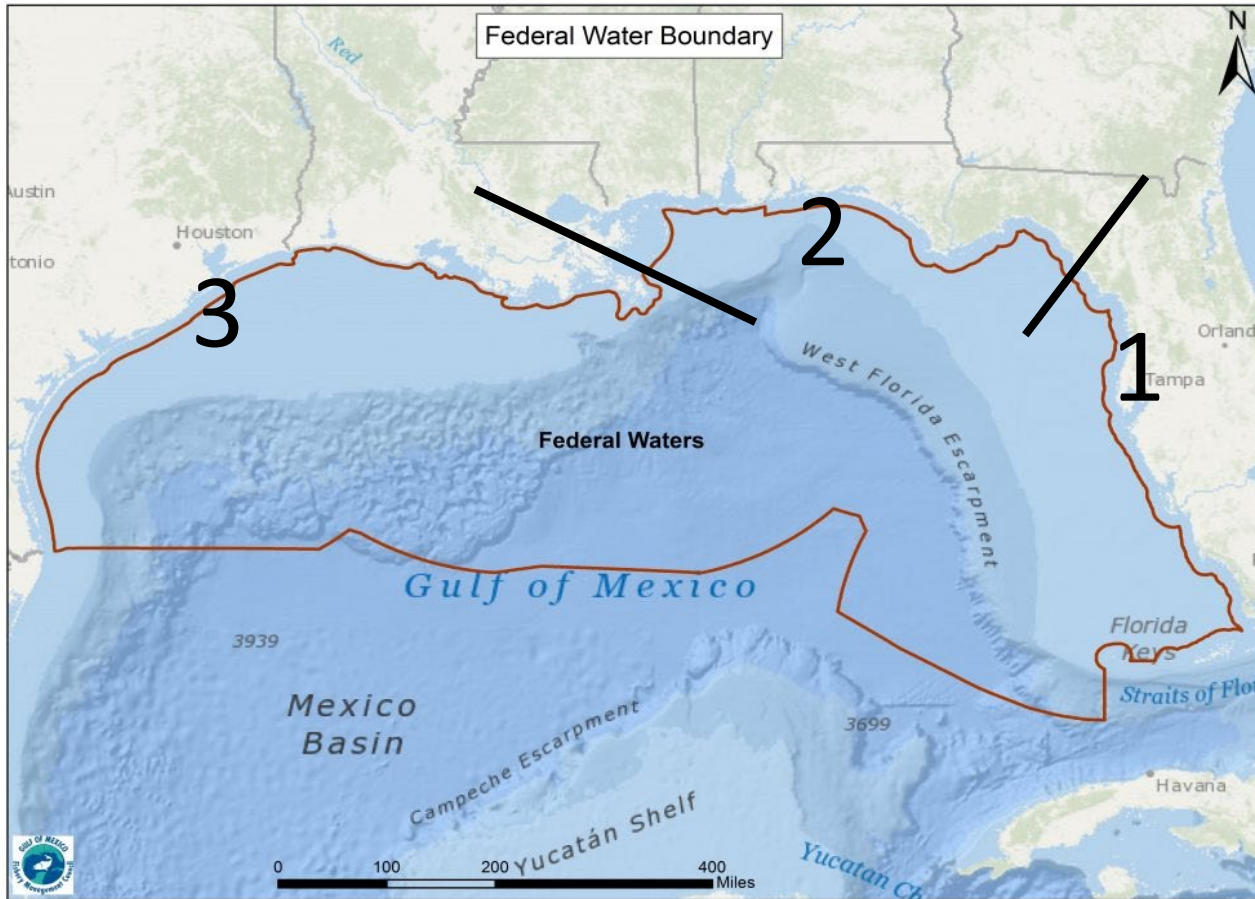
Allocation Pounds Traded in Dealer Communities

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
% of Allocation Pounds Traded Within Communities	70%	59%	66%	67%	69%	75%	73%	80%	75%	76%

Allocation Market Cointegration Analysis

- Given the tendency for allocation trading to occur through dealer-centric communities – is the allocation market segmented? Do different areas see different prices?
- A market is “the area within which the price of a good tends to uniformity...” (Stigler and Sherwin 1985)
- Law of One Price – The price of a homogenous commodity traded in an efficient market should converge to a single price through arbitrage (Lamont and Thaler 2003)

Allocation Market Cointegration Analysis



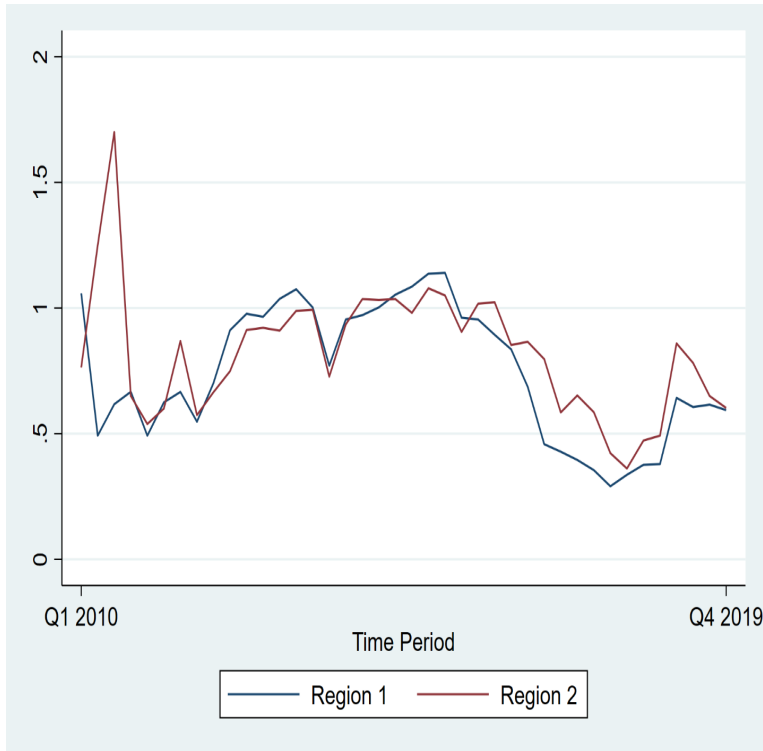
Region 1 – South and/or east of Taylor County, FL

Region 2 – Taylor County, FL to north and/or east of Plaquemines Parish, LA

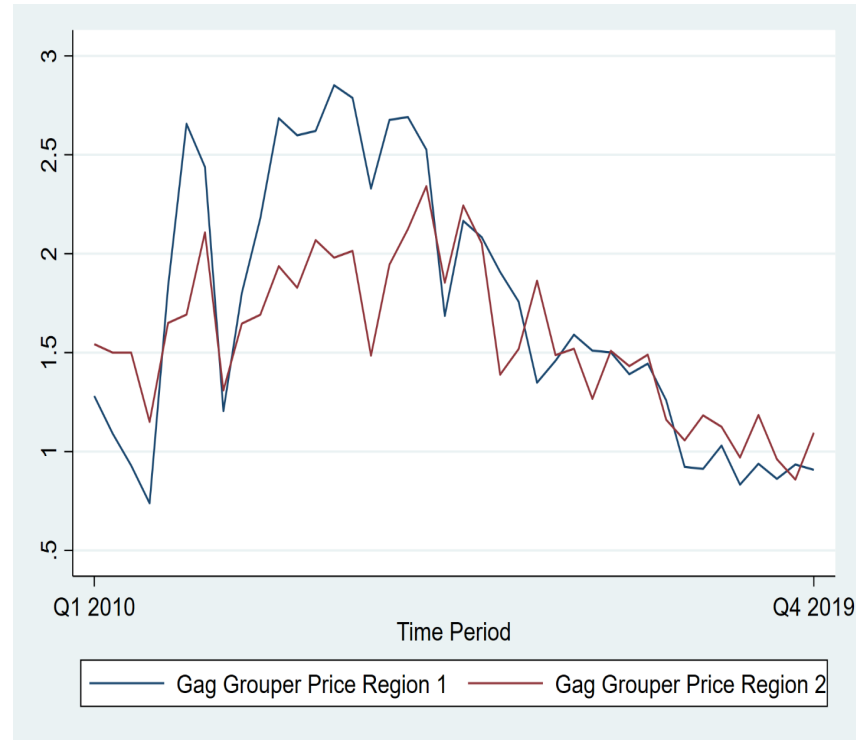
Region 3 – Plaquemines Parish, LA westward

	Buyer Region		
Seller Region	1	2	3
1	91.10%	6.01%	10.42%
2	6.30%	91.85%	14.79%
3	2.59%	2.14%	74.79%

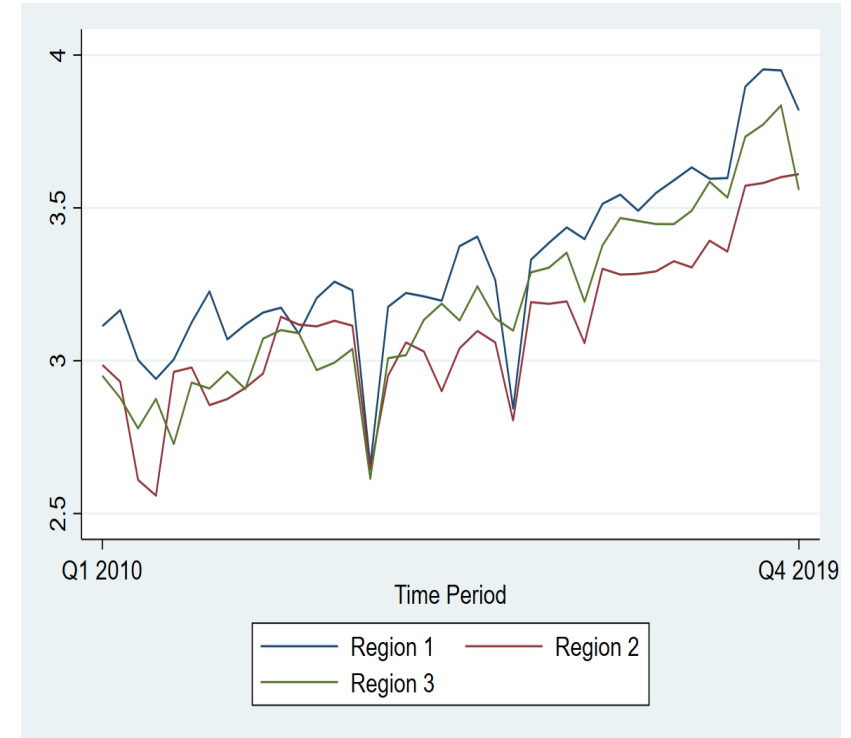
Cointegration Analysis Pricing Data



Red Grouper



Gag Grouper



Red Snapper

Cointegration Analysis Results

- Red grouper prices are cointegrated between regions 1 and 2, but we can reject the Law of One Price (prices move together but are not perfectly integrated)
- Gag grouper prices are cointegrated between regions 1 and 2, but we can reject the Law of One Price (prices move together but are not perfectly integrated)
- Red snapper prices are perfectly cointegrated between regions 1, 2, and 3 (failure to reject Law of One Price)
- Red and gag grouper findings with respect to the Law of One Price should be interpreted cautiously due to limited price data for Region 2

Conclusions

- Landings and quota markets are highly connected
- Dealers, generally, serve as brokers in the allocation market
- Dealers account for 20-50% of allocation pounds traded depending on species and year
- 71% of allocation trades occur within dealer-centric communities and this form of trading has increased in recent years
- Allocation prices across regions are cointegrated indicating prices move together



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Questions/Comments

