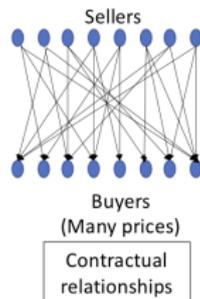


Pulp Friction: The Value of Quantity Contracts in Decentralized Markets

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The Pulp and Paper Industry



Market structure:

- Quantity contracts (> 80%): Quantity set often year in advance, prices negotiated monthly
 - Used also in other intermediate goods markets like coal, steel, plywood, gas...
- Decentralized spot (< 20%)

Research Question

Why does the pulp and paper industry rely on long-run quantity contracts?
How would welfare change under alternative market structures?

Coase (1937): Market structure minimizes transaction costs.

Price dispersion in the decentralized spot market
(search and bargaining frictions)
+
inelastic production

2 Answers

Using invoice and production data from a large seller we quantify 2 reasons:

- ① Contracts allow avoiding search frictions by locking in high surplus partners (estimate: 75% of the value)
- ② Serve as quantity insurance (estimate: 25% of the value)

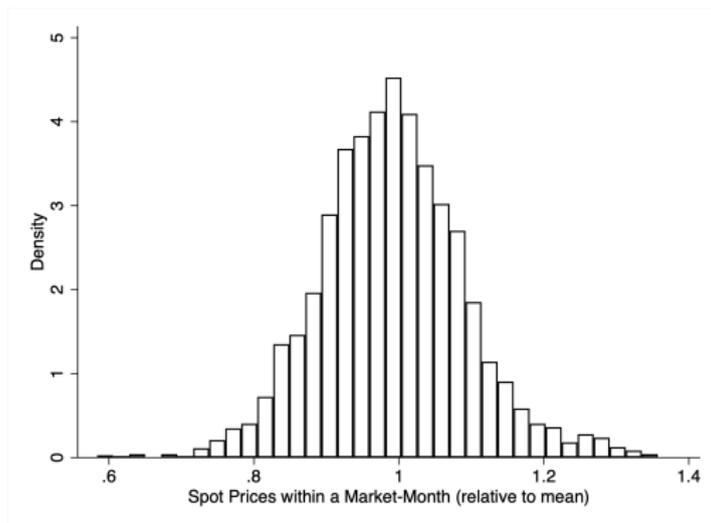
Trade-off:

Contractual relationships \Rightarrow lock in good partners & mitigate q risk
vs.

Spot trade \Rightarrow ex-post optimal allocation of quantity

Price Dispersion at the Spot

Figure: There Is Substantial Spot Price Dispersion



Notes. Mill gate price among spot buyers after removal of a market-month fixed effect, relative to mean of one. Market is defined as product-region.

Production is inelastic

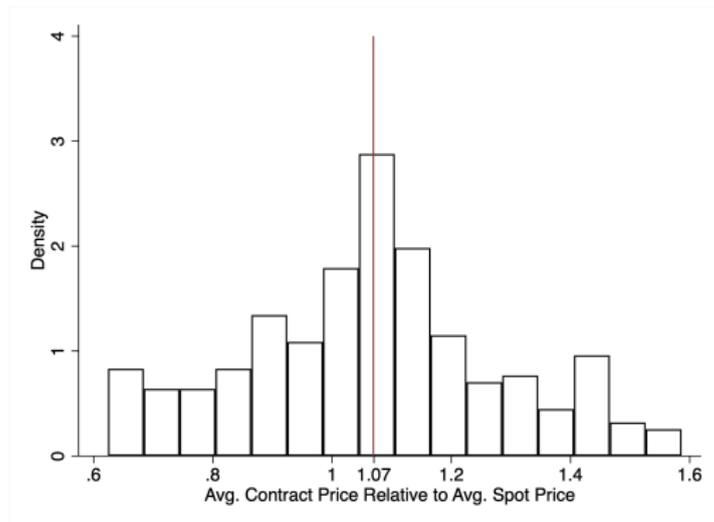
Table: Total Sales and Production Inelastic to Market Price in the Short Run

	(1)	(2)	(3)
	Log Total Sales	Log Production	Log Inventory
Log Market Price	-0.17 (0.11)	-0.01 (0.16)	-0.38 (0.15)
Observations	72	72	72
R-squared	0.19	0.07	0.28
Year FE	YES	YES	YES

Notes. Robust standard errors in parentheses. Observations are at the monthly level. Market price is the average price among the seller's trading partners.

Contract Buyers Are on Average Better

Figure: Average Contract Price $>$ Average Spot Price

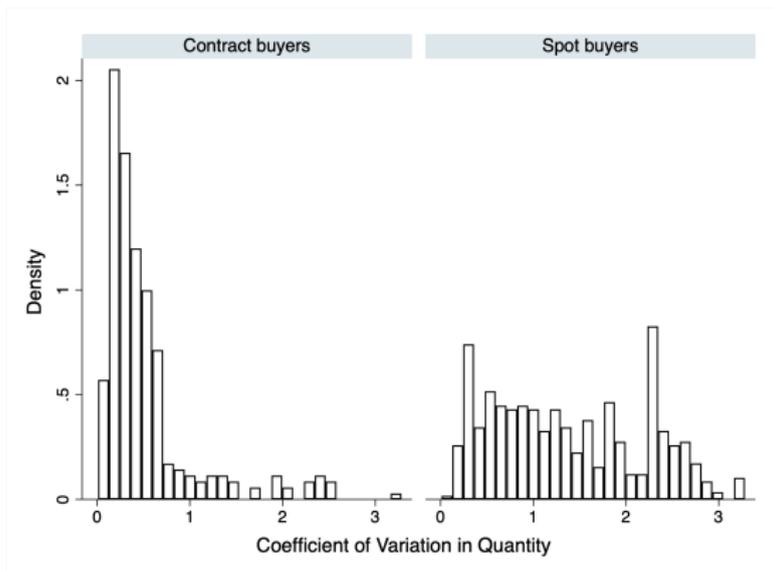


Notes. The median and mean values equal 1.07. Each observation is trade within a region, fiber, and month. The price measure is mill gate price.

Logistics costs a big part of this

Contract Buyers Are More Reliable

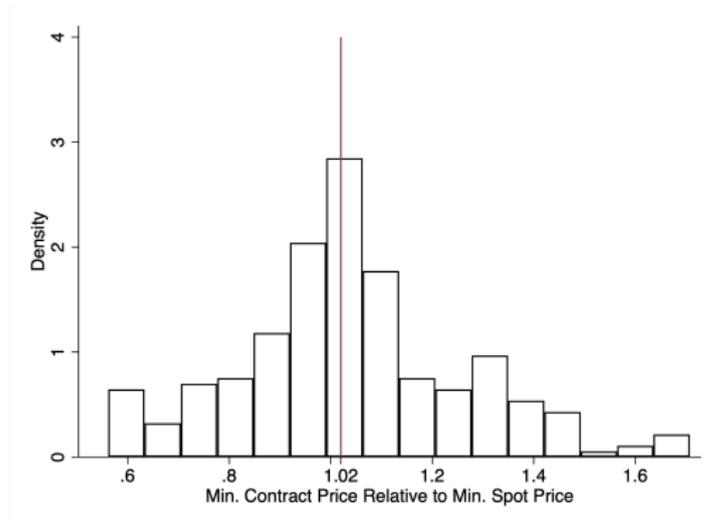
Figure: Contract Buyers Are More Reliable Than Spot Buyers



Notes. The coefficient of variation equals the standard deviation of quantity over the mean quantity. Each observation is a buyer within a region, fiber, and year.

Allocation Ex-Ante but not Ex-Post Optimal

Figure: Often: Lowest Contract Price < Lowest Spot Price



Notes. The median value equals 1.02 and the mean value equals 1.04. Each observation is trade within a region, fiber, and month.

Allocation not ex-post optimal \Rightarrow Cost of inflexible contract quantities

Why quantity insurance?

Claim: Price dispersion (F1) + inelastic supply (F2) \Rightarrow Risk Aversion

Intuition: Consider selling fixed Q to

- ① A big customer buying random q_c for fixed price p
- ② Rest to spot market with price dispersion where you can choose the best offers
 - the q_s th unit sold there fetches price $p_s(q_s)$ with $p' < 0$
 - Revenue from spot then $\int_0^{q_s} p_s(q) dq$

Total revenue:

$$\Pi(q_c) = pq_c + \int_0^{Q-q_c} p_s(q) dq$$

$$\Rightarrow \Pi''(q_c) = p'(Q - q_c) < 0$$

Seller endogenously risk-averse with respect to contracted quantity!

When contract buyer buys more, it replaces better spot buyers than what can be found when it buys less.

Structural Model

We estimate value of quantity contracts with a structural model matching main market institutions. Outline:

- ① Each year negotiate q contracts with buyers
 - quantities set to max expected surplus
 - *rebates* set to split expected surplus via Nash-in-Nash
- ② Each month:
 - Market shocks realize, q contracts supplied, market conditions determine “market price” on which buyer gets the rebate
 - Remaining supply traded to spot where
 - Seller meets randomly an exogenous fraction of potential buyers
 - Selects the best of them and makes them take-it-or-leave-it offers

Information and contracting frictions preclude complete contracts at step 1

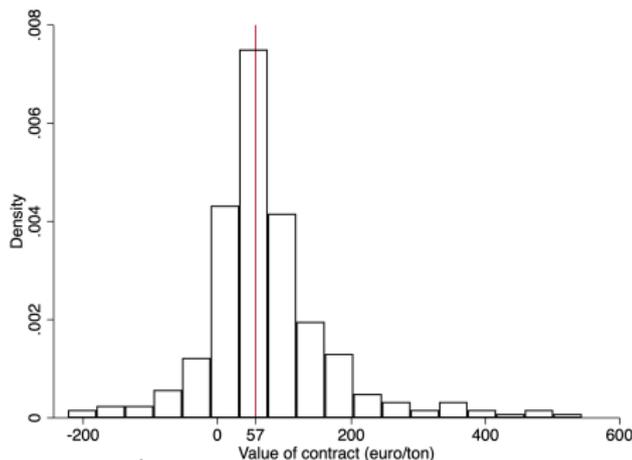
- Would require transfer of info about spot market outcomes...

Estimate with SMM in two steps

Counterfactual 1: Value of contracts

For each contract buyer consider moving them to spot. Calculate difference in surplus compared to current allocation.

Figure: Quantity Contracts Are Valuable

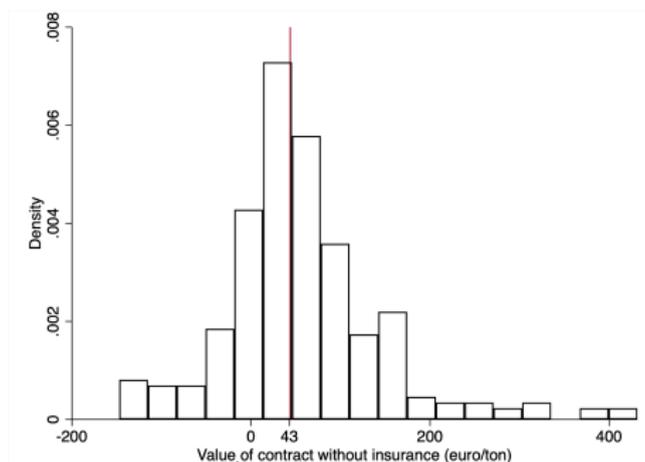


Notes. Median value 57 €/ton. Observation = contract buyer within a market and year. Median market price in Europe for hardwood pulp: 775€/ton.

Counterfactual 2: Value of insurance vs. buyer selection

Predict for each contract buyer what their quantity variance at spot would be. Then calculate value of contracts with this new variance.

Figure: Quantity Contracts Are 25% Less Valuable Without Quantity Insurance

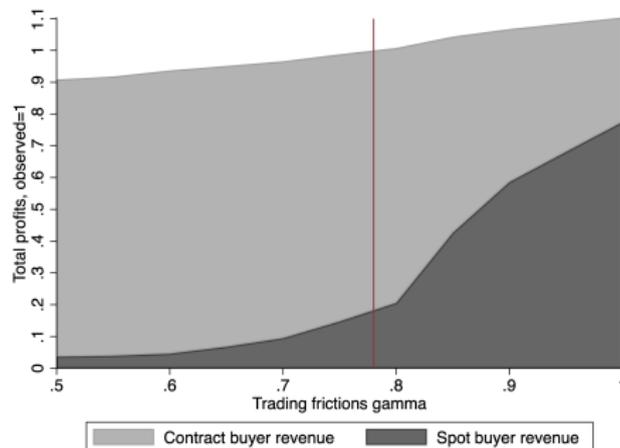


Notes. The median value 43 € /ton. Observation = contract buyer within a market and year.

Counterfactual 3: Role of trading frictions at spot

Change the exogenous fraction of buyers (γ) the seller meets at spot.
 Reallocate buyers between spot and contract.

Figure: Profits Are Higher When Trading Frictions Diminish



With lower frictions more traded at spot and profits are higher.

The End

Thank you!