

Energy & Protein Markets

Oil Prices and Aquaculture: A Second-Order Shock with *First-Order* Consequences

Energy regimes do not arrive at the farm gate as fuel. They arrive as feed, freight, fertilizer, and finally as price. We map the transmission — and identify the producers, regions, and strategies that survive a structurally higher oil curve.

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01 Five Conclusions for Allocators and Operators

Oil acts on aquaculture predominantly through the feed channel, not the fuel pump. The spread between marginal and low-cost producers is the variable that compounds across cycles.

INSIGHT 01

The transmission is feed, not fuel.

Direct on-farm energy is 5–12% of cash cost. Feed is 50–70%. Oil's largest channel into aquaculture P&L runs through soy, soybean meal, and reduction-fishery diesel — not aerator pumps.

INSIGHT 02

Cost curves diverge before they shift.

High-oil regimes do not raise all-in costs uniformly. They steepen the right tail of the global cost curve. Marginal Asian shrimp and offshore salmon operators compress first; integrated operators absorb later and less.

INSIGHT 03

Pricing power is asymmetric across species.

Premium species (Atlantic salmon, premium canewater) retain pass-through. Staple species (tilapia, pangasius) do not — their consumers substitute toward poultry within one quarter. Margin compression is a staple-species phenomenon first.

INSIGHT 04

Vertical integration is a hedge with a measurable spread.

Producers owning feed mills or hatcheries internalize 8–14 points of margin volatility in a stress scenario. The integration premium is observable in EBITDA dispersion across cycles.

INSIGHT 05 — STRATEGIC

Energy cycles are consolidation accelerators. They expose which balance sheets were already insolvent at \$90 oil and merely solvent at \$70. The next 18 months of oil volatility will redistribute aquaculture market share more than any single technology shift since recirculating systems.

For allocators: long the integrated, short the marginal, and price feed-mill ownership as the option it is. For operators: the question is no longer whether to vertically integrate — it is whether to do so before or after the next oil shock prices it in.

02 How Oil Reaches the Farm Gate

Three channels connect crude oil prices to aquaculture production economics — each with a different transmission speed, magnitude, and reversibility.

A. Direct Energy Inputs — 5–12% of cash cost

On-farm energy is 5–12% of cash cost. Feed is 50–70%. Oil's largest channel into aquaculture P&L runs through soy, soybean meal, and reduction-fishery diesel — not aerator pumps. A 30% move in Brent propagates with leverage — but unevenly.

Energy intensity by system

System	Energy (kWh/kg)	Primary Driver	Oil Sensitivity
Atlantic Salmon (sea-cage)	1.5–3.0	Feed transport, harvest	Low–Medium
Shrimp (pond, intensive)	3.0–7.0	Aerators, pumps	Medium–High
Pangasius (Vietnam ponds)	1.0–2.5	Minimal mechanical	Low
Tilapia (pond, tropical)	1.5–3.5	Aeration, feed delivery	Medium
Salmon RAS (land-based)	25–60	Heating, oxygenation, recirculation	Very High

B. Feed — The Dominant Channel — 50–70% of cash cost

Feed cost is the principal transmission mechanism. It is also the least reversible. A 30% rise in Brent does not produce a 30% rise in feed; in our reference framework it produces 8–15%, with a 1–3 quarter lag and asymmetric impact across the formulation.

Margin sensitivity — illustrative

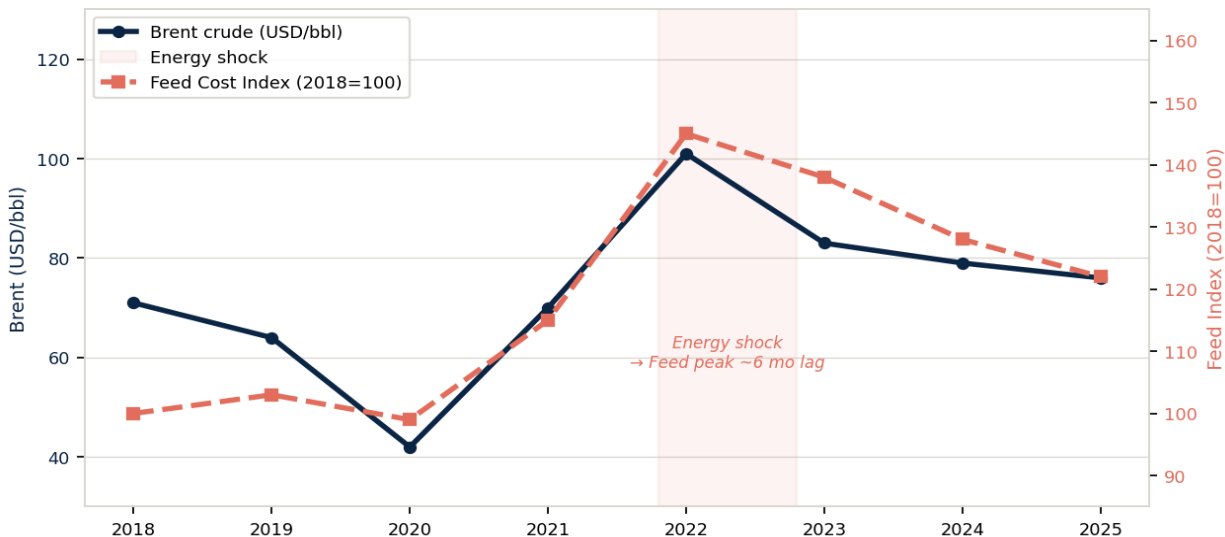
Oil Scenario	Feed Cost Δ	EBITDA Impact (staple)	EBITDA Impact (premium)
Base (\$75 Brent)	—	—	—
Mild shock (\$90)	+4 to 7%	-3 to 5 pts	-1 to 2 pts
Stress (\$110)	+9 to 14%	-7 to 11 pts	-2 to 4 pts
Severe (\$130+)	+15 to 22%	-13 to 18 pts	-4 to 7 pts

C. Logistics & Cold Chain — 6–18% of landed cost

Cold chain and logistics costs are oil-sensitive and geographically heterogeneous. Norwegian salmon shipped to Asian markets carries 2–3× the freight exposure of Chilean product shipped to the U.S. Gulf.

Exhibit 01 Oil → Feed Transmission: Brent vs. Aquaculture Feed Cost Index

Stylized correlation, 2018–2024. Feed cost index lagged 1–2 quarters relative to crude.



Reference data

Year	Brent (USD/bbl)	Feed Cost Index (2018=100)
2018	71	100
2019	64	103
2020	42	99
2021	70	115
2022	101	145
2023	83	138
2024	79	128
2025	76	122

Stylized correlation, 2018–2025. Feed index is composite (soybean meal, fishmeal, wheat, additives). Feed cost index lagged ~1–3 quarters relative to Brent. Source: Plutus iQ analysis; illustrative.

03 Oil Does Not Lift the Curve. It Steepens It.

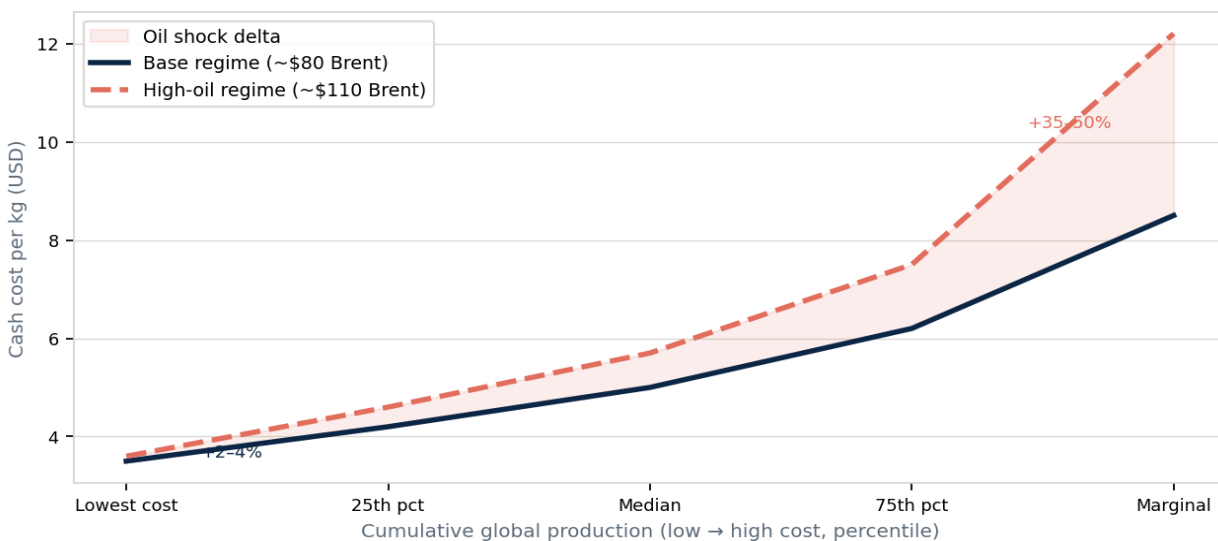
The conventional framing understates the structural effect. Oil volatility compresses the margin of the marginal producer while leaving the low-cost integrated producer relatively protected.

The mechanism — three compounding effects

- 1 · Feed leverage: marginal producers carry higher feed-cost ratios. A 10% feed-cost rise hits them 1.5–2× harder in EBITDA terms.
- 2 · Working capital strain: high-oil regimes increase feed payables and lengthen cash cycles, disproportionately affecting undercapitalized operators.
- 3 · Demand substitution: when retail prices rise, consumers trade down — but only for commodity species. Premium operators face less volume risk.

Exhibit 02 Conceptual Global Aquaculture Cost Curve — Base vs. High-Oil Regime

The shock pivots the curve around the low-cost anchor. Marginal producers (right tail) absorb the full delta.



Reference data

Cohort	Base cost/kg (~\$80 Brent)	High-oil cost/kg (~\$110 Brent)	Delta
Lowest cost (0–10th pct)	\$3.50	\$3.60	+2–3%
25th percentile	\$4.20	\$4.60	+9%
Median (50th pct)	\$5.00	\$5.70	+14%
75th percentile	\$6.20	\$7.50	+21%

Cohort	Base cost/kg (~\$80 Brent)	High-oil cost/kg (~\$110 Brent)	Delta
Marginal (90th–100th pct)	\$8.50	\$12.20	+44%

Conceptual cost curve. Estimates illustrative. Source: Plutus iQ framework; synthesized from operator disclosures and commodity cost models.

04 Pricing Power Determines Who Eats the Shock

Aquaculture is modeled as an agricultural sector. In our framework it behaves as a derivative energy asset: roughly 50–70% of the cost of farmed shrimp and salmon is feed, and feed itself is a function of crop economics and marine ingredients whose pricing is governed by diesel, fertilizer, and freight.

Premium vs. staple seafood

Premium species retain pricing power through the feed channel. Staple species remain pass-through constrained — their consumers substitute toward poultry within one quarter.

Demand elasticity summary

Species	Price Elasticity	Substitute	Pass-Through
Atlantic Salmon	-0.4 to -0.6	Other premium fish	High
Shrimp (premium)	-0.6 to -0.9	Other seafood	Medium
Tilapia	-1.1 to -1.6	Chicken, pork	Low
Pangasius	-1.3 to -1.8	Tilapia, chicken	Very Low
Shrimp (value)	-1.0 to -1.4	Tilapia, domestic	Low

05 Winners and Losers Are Geographic

Norway: Low direct energy exposure, high feed-cost exposure. Net: medium overall sensitivity, strong pricing power. Integrated leaders (Mowi, SalMar, Cermaq) well-positioned.

Chile: Similar species mix to Norway, but higher logistics exposure on longer shipping lanes to Asia. Net: medium-high sensitivity on export routes.

Ecuador (shrimp): Low energy costs, high feed exposure, limited pricing power. Net: medium sensitivity, volume-driven margin model.

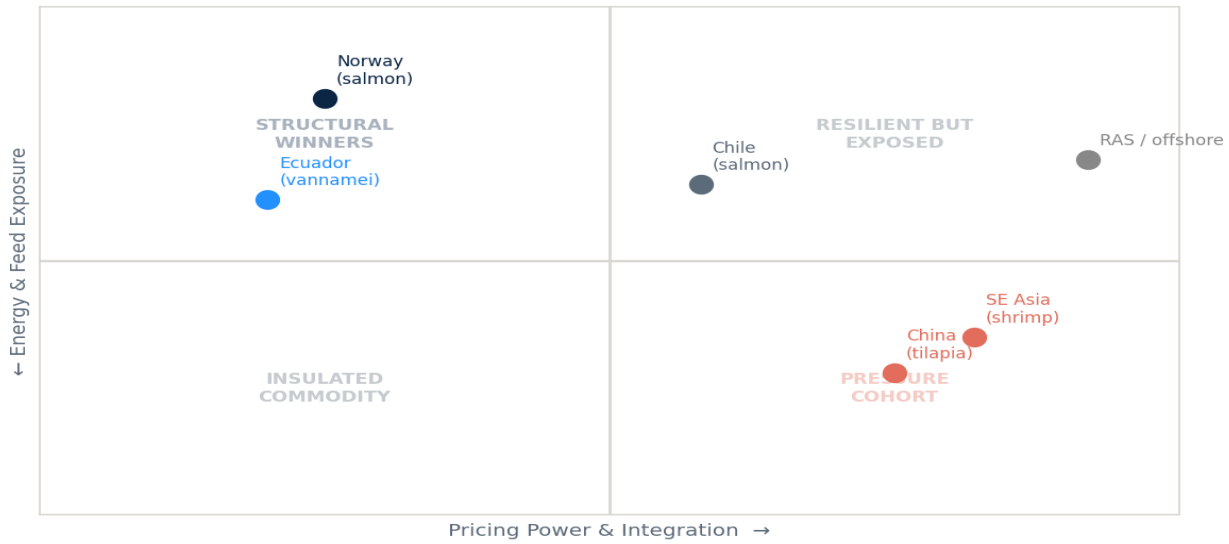
Vietnam (pangasius, shrimp): Low direct energy, feed-dependent, price-constrained. Net: medium-high sensitivity for shrimp; lower for pangasius.

Southeast Asia (tilapia, shrimp — intensive): Highest direct energy exposure, limited pricing power. Net: high sensitivity; most vulnerable to sustained high-oil regimes.

RAS / Land-based salmon: Very high direct energy exposure (25–60 kWh/kg). Many projects uneconomic above \$100 Brent. Net: severe sensitivity.

Exhibit 03 Regional Competitiveness Matrix — Energy Exposure vs. Pricing Power

Lower-left quadrant (low exposure, high pricing power) = most resilient. Upper-right = most vulnerable.



Reference data

Region / Species	Energy & Feed Exposure	Pricing Power	Assessment
Norway (salmon)	Low	High	Structural winner — vertical integration + pricing power
Ecuador (vannamei)	Low	Medium	Resilient — low energy, high efficiency, commodity price risk
Chile (salmon)	Medium	Medium	Exposed — freight + biology, some integration
SE Asia (shrimp)	High	Low	Pressure cohort — energy + feed intensive, limited pass-through
China (tilapia)	High	Low	Pressure cohort — volume model, margin thin
RAS / offshore	Very High	High	Structural risk — energy-intensive, uneconomic above \$100

Qualitative matrix. Axes represent relative positioning. Source: Plutus iQ analysis.

06 Three Oil Regimes, Three Different Industries

We model three scenarios over an 18-month horizon, anchored to plausible Brent trajectories and their second-order effects on feed costs, logistics, and demand.

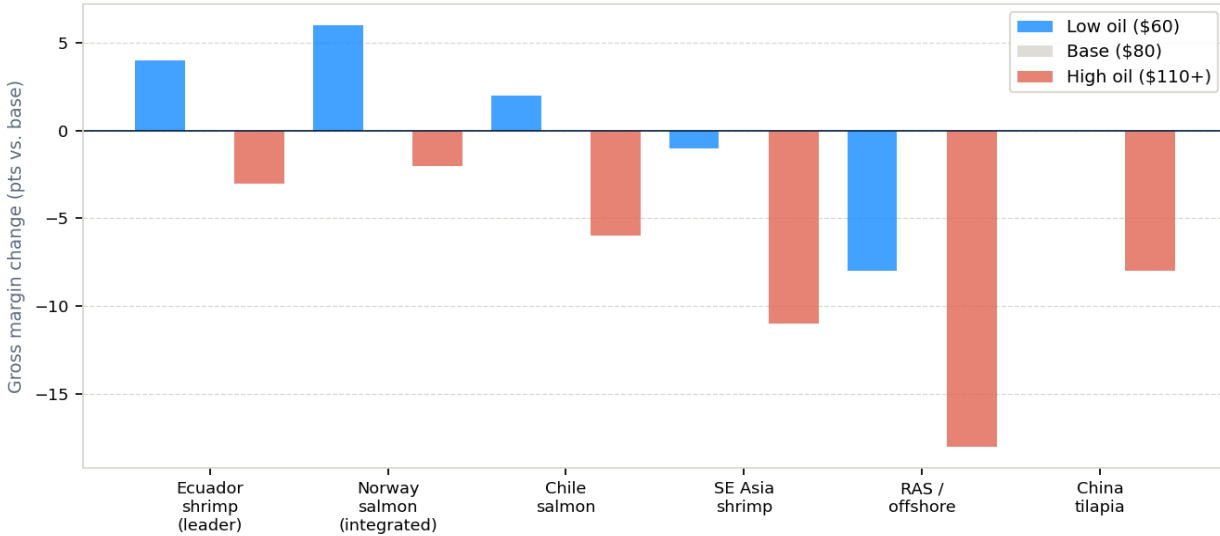
Scenario A — Base (\$70–80 Brent): Mild feed-cost pressure. Integrated operators expand margin. No material consolidation trigger.

Scenario B — Stress (\$90–110 Brent): Feed costs rise 9–14%. Staple-species producers face EBITDA compression of 7–11 points. First consolidation wave begins. RAS projects pause or fail.

Scenario C — Severe (\$120+ Brent): Feed costs up 15–22%. Marginal producers exit or are acquired. Protein substitution accelerates. Vertical integration premium reprices sharply upward.

Exhibit 04 Scenario Outcomes — Margin Impact by Producer Cohort

Estimated change in gross margin (percentage points) relative to Base scenario.



Reference data

Producer Cohort	Low oil (\$60) vs. base	Base (\$80)	High oil (\$110+) vs. base
Ecuador shrimp (leader)	+4 pts	-	-3 pts
Norway salmon (integrated)	+6 pts	-	-2 pts
Chile salmon	+2 pts	-	-6 pts
SE Asia intensive shrimp	-1 pts	-	-11 pts
RAS / offshore	-8 pts	-	-18 pts
China tilapia	0 pts	-	-8 pts

Estimated change in gross margin (percentage points) vs. base case by oil scenario. Estimates illustrative. Source: Plutus iQ framework.

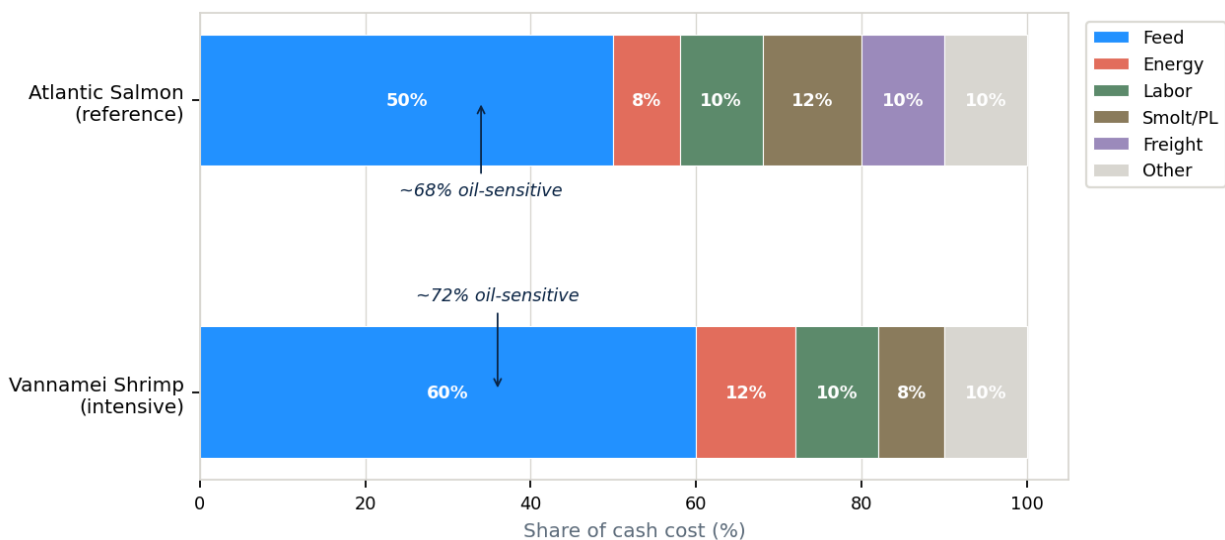
07 Where the Money Goes

Atlantic Salmon reference: Feed 45–50% | Labor 12–15% | Smolt/fingerling 8–10% | Depreciation 8–12% | Logistics 6–10% | Energy 2–4% | Other 8–12%.

Whiteleg Shrimp reference: Feed 50–60% | Labor 10–15% | Energy 5–10% | Chemicals/health 5–8% | Logistics 6–12% | Other 8–14%.

Exhibit 05 Aquaculture Cost Structure — Shrimp vs. Salmon Reference Stack

Approximate share of cash cost of production. Source: Plutus iQ synthesis; operator disclosures, FAO.



Reference data

Cost Component	Shrimp (intensive)	Salmon (reference)	Oil sensitivity
Feed	60%	50%	Yes — soy, fishmeal, wheat all oil-linked
Energy (direct)	12%	8%	Yes — diesel, electricity
Labor	10%	10%	No
Smolt / Post-larvae	8%	12%	Partial — feed + transport
Freight / cold chain	0%	10%	Yes — fully oil-linked
Other	10%	10%	Partial
OIL-SENSITIVE TOTAL	~72%	~68%	Feed + direct energy + freight

Approximate share of cash cost of production. Oil-sensitive components include feed, direct energy, and freight. Source: Plutus iQ synthesis; operator disclosures, FAO.

08 Implications for Operators and Allocators

1 • Industry consolidation

Energy cycles are consolidation accelerators. They expose which balance sheets were already insolvent at \$90 oil and merely solvent at \$70. The next 18 months of oil volatility will redistribute aquaculture market share more than any single technology shift since recirculating systems.

2 • Vertical integration

Producers owning feed mills or hatcheries internalize 8–14 points of margin volatility in a stress scenario. For operators not yet integrated, the window to do so cheaply closes as oil rises.

3 • Feed innovation — alternative proteins

Single-cell protein, insect meal, and algae-based oils offer partial insulation. The economic case strengthens at \$90+ Brent.

4 • Localization vs. globalization

Freight costs strengthen the case for regional production and consumption loops. We expect more regional aquaculture investment in the U.S. and coastal EU/UK markets, on a multi-year horizon.

09 The Plutus iQ Perspective

Oil-aquaculture is not a research narrative. It is a quantifiable system of feed, freight, and pricing power that can be modeled, monitored, and stress-tested.

Our work for institutional clients sits at the intersection of fundamental sector knowledge and quantitative modeling. Plutus iQ maintains scenario-driven cost models, regional cost-curve mapping, and supply-demand simulators for the major farmed species, calibrated against producer-level data.

Plutus iQ Capabilities

What we build for clients in this space.

We deliver decision-ready analysis: cost-curve diagnostics by region and species, scenario-driven margin models that ingest live energy and feed inputs, and supply-demand forecasts that quantify regional rotation under stress.

<p>Scenario Modeling Custom oil and feed scenarios mapped to client-specific producer cohorts, regions, and contract structures. Outputs sized for IC and board reporting.</p>	<p>Cost Curve Analytics Custom and species-level cost-curve construction with marginal-producer identification and dispersion tracking through cycle.</p>	<p>Supply–Demand Forecasting Hybrid agent-based and structural models translating energy regimes into regional supply growth, trade flows, and price formation.</p>
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For institutional clients evaluating aquaculture exposure — direct investment, processor due diligence, feed-company underwriting, or sector allocation — we offer tailored analytical work product against this framework.

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