

How Concentrated Is Nitrogen Fertilizer?

More Concentrated Than Oil Refining, and Measured Against the Wrong Gas Price

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Monaco, Paulson, Schnitkey and Zulauf reported on consolidation in the U.S. nitrogen fertilizer industry in *farmdoc daily* in May 2026. Thirty-three ammonia plants operated in the United States in 2023, down from 46 in 2000. The four largest firms held 70 percent of domestic ammonia capacity, up from 50 percent. CF Industries held 39 percent, Nutrien 16 percent, Koch Fertilizer 10 percent, and LSB Industries 5 percent. The Herfindahl-Hirschman index for domestic ammonia capacity stood at 2,010.

That describes a concentrated industry. It does not establish that the industry exercises market power over farmers, and no concentration statistic can.

1 Reading the index

The Herfindahl-Hirschman index adds up the squared market share of every firm in a market. A single firm holding the whole market scores 100 squared, or 10,000, the maximum. Ten firms of equal size score 1,000. Twenty equal firms score 500. A higher number means a more concentrated market and weaker competitive pressure, and the squaring means a market with one dominant firm scores far higher than one with several firms of similar size.

Current federal merger guidelines, issued in 2023, treat anything above 1,800 as highly concentrated. The guidelines they replaced put that line at 2,500. Ammonia at 2,010 clears the new threshold and would have fallen short of the old one. Monaco and coauthors make this point themselves. The industry was not reclassified because its structure changed but because the threshold moved.

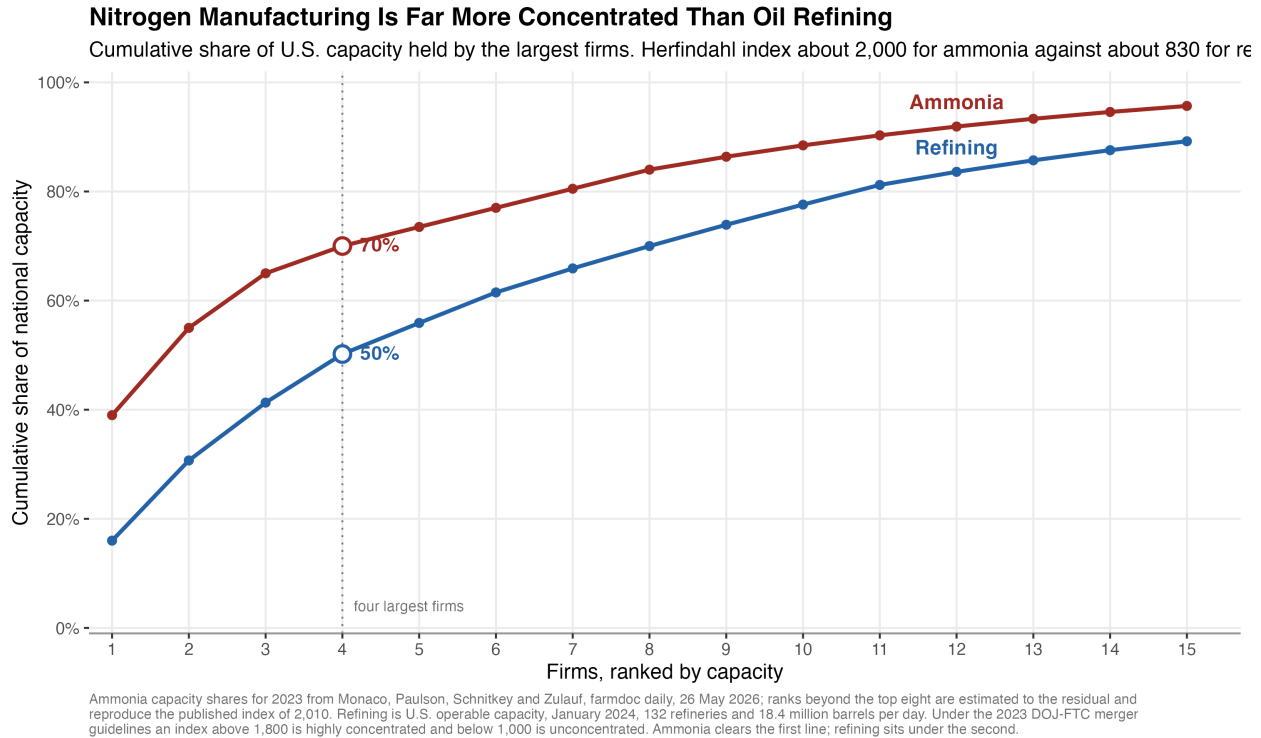


Figure 1: Nitrogen vs refining concentration

2 Nitrogen compared with oil refining

Both industries turn a widely traded hydrocarbon into something farmers and drivers cannot do without. Both need plants costing billions of dollars and years to build. Both depend on pipelines, railroads and terminals that limit where product can go. Both have consolidated. Nitrogen is therefore often described as agriculture's refining industry.

Figure 1 plots the cumulative share of national capacity held by the largest firms in each industry. The gap between the two curves is the difference in concentration.

Figure 1. Nitrogen manufacturing is far more concentrated than oil refining

U.S. refining runs 18.4 million barrels per day across 132 refineries. The largest refiner holds 16 percent of national capacity and the four largest hold about half. The index for refining works out near 830, below any threshold that any version of the merger guidelines has treated as a concern. Ammonia is roughly two and a half times more concentrated. CF Industries alone holds 39 percent of ammonia capacity, close to the 41 percent that Marathon, Valero and ExxonMobil hold of refining between them. The industry most often used to explain nitrogen concentration turns out to be considerably less concentrated than nitrogen itself.

3 The number depends on where the line is drawn

The Agricultural and Food Policy Center at Texas A&M measured nitrogen concentration at three geographic scopes in a 2024 report prepared for U.S. Senators. Inside the United States the index is 2,382 and the four largest firms hold 77 percent. Measured globally, the index is 368 and the four largest firms hold 13 percent.

The same industry is highly concentrated at 2,382 and unconcentrated at 368. No firm entered or left between those calculations. Only the boundary around the market changed.

Neither number is right on its own, and the AFPC authors say so. A domestic boundary ignores supply that arrives through trade. A global boundary counts producers who will never ship to the United States, including more than 700 nitrogen firms in China that supply none of it, and ignores the freight, tariffs and sanctions that keep much of the rest out. The real figure sits somewhere between, and finding it is not a matter of counting firms more carefully.

4 The margin is measured against the wrong gas price

The strongest argument for nitrogen market power runs through the gap between fertilizer prices and feedstock costs. Anhydrous rose more than \$700 per ton between April 2021 and April 2022, an increase of 118 percent, while the natural gas embedded in a ton of ammonia rose only \$138, or 19 percent of the total. Roughly four fifths of the increase went unexplained by feedstock cost. In a concentrated industry, that invites an explanation involving market power.

The gas price behind that calculation is Henry Hub, which went from \$2.66 to \$6.60 over the period. Henry Hub is what American producers pay. It is not what sets the price they receive. Over those same months European gas rose roughly tenfold, and European ammonia plants, which supply the marginal tons that clear the world market, either shut down or ran at costs several times the American level. World ammonia prices rose to match that marginal cost. American producers buying gas at \$6.60 while the marginal ton was made from gas many times dearer collected the difference.

The price data bear this out. Across monthly observations from 2009 through August 2026, European gas correlates 0.83 with anhydrous. Crude oil correlates 0.54. Henry Hub, the

gas American plants actually burn, manages 0.50. The feedstock American producers buy explains less about American fertilizer prices than the feedstock burned an ocean away.

5 Cheap gas is not the same as market power

A markup is what a firm charges above the competitive price because its rivals cannot discipline it. Reduce concentration or allow entry and a markup erodes. A rent is what a producer earns because its own costs sit below those of the producer setting the price. Rents come from cost position rather than market structure, and they persist no matter how many firms share them.

American ammonia plants sit on the cheapest large gas resource in the industrial world. When world gas prices spike and American gas does not, the spread goes to whoever owns an American plant. It would go to thirty-three independent owners exactly as it goes to four large ones, because no American producer, and not all of them together, can build fast enough to move the world price. In margin data, a price taker earning a rent looks identical to a price maker charging a markup.

Subtracting American feedstock costs from a world-set price measures the American cost advantage. It does not measure a markup.

6 Do prices come down the way they go up?

Concentration describes structure and margins describe outcomes. Neither shows how firms actually behave. Whether prices fall as readily as they rise does show something, and it is the standard test in retail fuel markets. It does not appear to have been applied to nitrogen.

Running it on 210 months of anhydrous prices against European gas and corn gives a split answer. The immediate response to a gas move is the same in both directions. What differs is what happens afterward. When anhydrous sits below the level that gas and corn imply, it closes the gap at about 16 percent a month, which works out to a half-life of four months. When anhydrous sits above that level, the measured tendency to come back down is indistinguishable from zero.

Figure 2. Anhydrous rises with European gas and does not fully come back

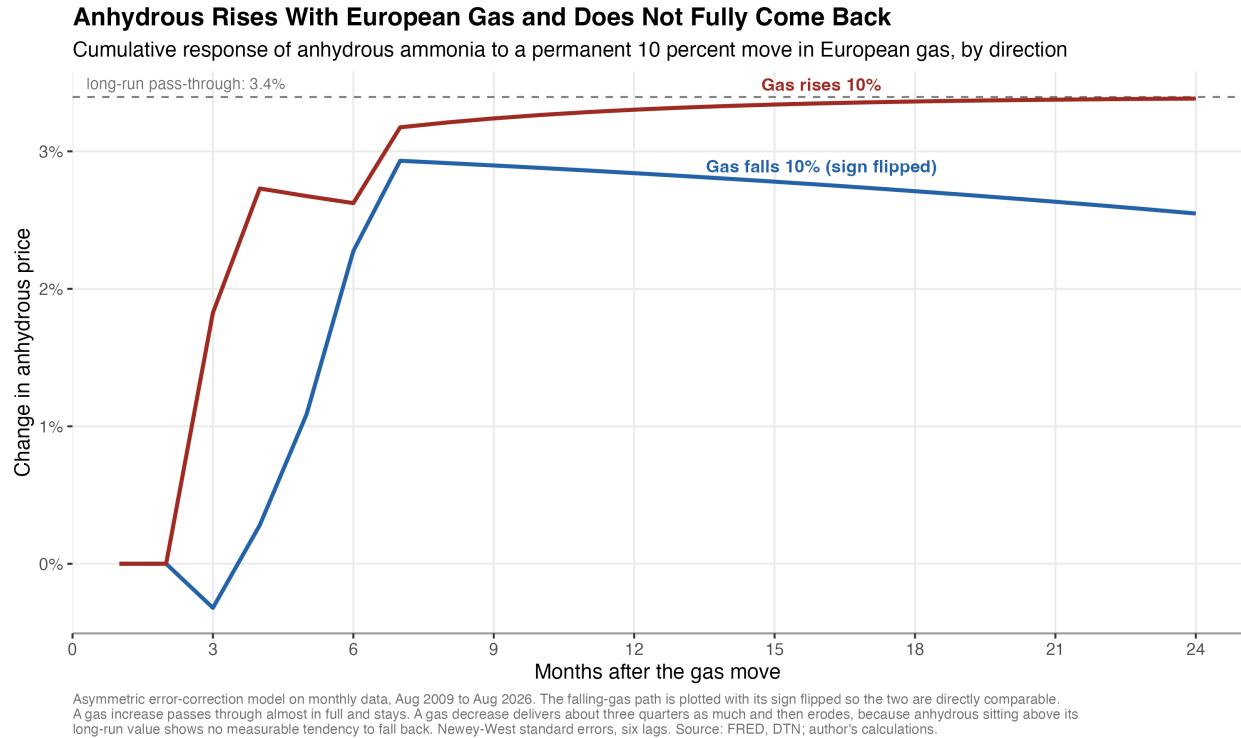


Figure 2: Anhydrous asymmetric pass-through

Figure 2 traces what that implies. A permanent 10 percent rise in European gas lifts anhydrous 3.4 percent and the increase holds. A 10 percent fall pushes anhydrous down 2.9 percent at the deepest point, about seven months later, and the decline then erodes to 2.6 percent by the second year. A price decrease delivers roughly three quarters of what the same size increase delivers, and the shortfall grows rather than closing.

The pattern is not left over from the 2021 and 2022 shock. Dropping those years changes almost nothing, and the asymmetry is actually larger when measured on 2009 through 2020 alone.

7 Where the stickiness sits is unresolved

The chain from European gas to the farm gate runs through manufacturers and then through distribution. Tested separately, neither stage shows the pattern strongly enough to stand on its own. Only the full chain does. The result cannot be pinned on the four firms that make the product rather than on the layer that delivers it.

Recent months argue for looking downstream. Between June and August 2026 the wholesale price index for nitrogen manufacturing fell 18 percent. Retail anhydrous went from \$1,076 to \$960 to \$964 per ton, falling and then rising while the wholesale index dropped another 9 percent in that last month. Whatever was slow to come down in that stretch was not the manufacturer.

One further caution belongs with the finding. Prices that fail to fall back toward fundamental value are also what a missing cost would produce. If something persistent and expensive is absent from the calculation, whether freight, tariffs or a long run of plant outages, it would look the same in the data.

8 What this means for buyers

Anhydrous sold for \$964 per ton in August 2026. Given gas and corn prices at the time, the model used in this series puts fundamental value at \$814. Had the Strait of Hormuz never closed, the estimate falls near \$748. The premium is 18.4 percent against fundamental value and 28.8 percent against the no-closure case.

Those premiums are real and large, but the concentration evidence does not show they are a markup rather than the price of nitrogen in a world where the marginal ton is expensive to make. Domestic capacity is concentrated, more so than refining. The same industry measured globally is not concentrated at all, and the margin usually cited as proof of market power is measured against a feedstock price that does not set the product price. Both point toward rent rather than markup.

The asymmetry is harder to dismiss. A price taker whose world benchmark falls has no option to decline to follow it down, so a price that returns to fundamental value from below but not from above is not explained by cheap gas, and not explained by tight supply either, which binds in both directions. Market structure is one candidate. Inventory costs, pre-pay contracts, seasonal demand and local dealer competition are others, and none of those requires concentration.

For a farm buying nitrogen, the practical content is narrower than the policy argument suggests. High prices during a global supply disruption are not by themselves evidence of anything improper, and waiting on an antitrust case is not a procurement plan. The asymmetry is the part with operational value. A price that has fallen too far relative to gas and corn tends to correct within a few months, while a price that has risen too far tends

to stay there. A premium standing in front of the application window should be treated as likely to persist through it.

9 A note on sources and method

Ammonia capacity shares and the 2,010 index are from Monaco, Paulson, Schnitkey and Zulauf (2026). Refining shares are U.S. operable capacity for January 2024. Concentration at the three geographic scopes, and the \$138 natural gas figure, are from the Agricultural and Food Policy Center at Texas A&M (2024). Anhydrous prices are the DTN national average; European gas is the IMF global EU gas price through FRED; corn is the monthly average of daily nearby futures.

The asymmetry test uses an error-correction model on monthly data from March 2009 through August 2026, allowing price increases and decreases to behave differently and allowing separate speeds of return to fundamental value from above and below. A longer version of this analysis, with the estimated coefficients, significance tests, robustness checks and the stage-by-stage decomposition, is available on request.

10 Sources

- Monaco, H., N. Paulson, G. Schnitkey and C. Zulauf. “Consolidation Trends in the U.S. Nitrogen Fertilizer Industry.” *farmdoc daily*, 26 May 2026. <https://farmdocdaily.illinois.edu/2026/05/trends-in-the-us-nitrogen-fertilizer-industry.html>
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