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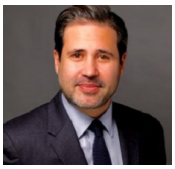


MOVING FROM CARRY TO ANTI CARRY

Table of Contents

In our fourth-quarter 2024 letter, we introduced a framework that has since shaped much of our thinking about commodity cycles—the "Carry Bubble." Drawing heavily on *The Rise of Carry* by Lee, Lee, and Coldiron, we argued that the four major commodity cycles of the last 125 years fit neatly within a broader and more predictable carry cycle. It is worth returning to that idea now, and examining how such a regime ultimately ends and what may greet investors once it does.

The authors describe with careful precision the mechanisms that produce and extend a carry regime. The standard example involves borrowing in a chronically low-yielding currency, such as the yen, and investing in a higher-yielding asset, often in Australia. Provided exchange rates remain calm, the trader simply earns the spread between borrowing costs and asset returns.

Lee, Lee, and Coldiron argue that this is only one instance of a much larger class of trades.

What they share is straightforward: each relies on leverage, and each depends on a world that does not change too abruptly. They are, in effect, short-volatility trades that do well when conditions stay steady.

In theory, such trades should not survive. Arbitrage should eliminate any persistent yield difference, either by pushing up asset prices or shifting exchange or funding rates. Yet the historical record shows that carry trades not only exist, but often produce durable positive expected returns.

The authors note that this outcome is not as puzzling as it seems. Carry trades often offer small, steady gains until they meet the kind of volatility that wipes out years of prior profits. The returns simply compensate the holder for that eventual risk. It is the quintessential picking up of pennies in front of the proverbial steam-roller.

Once you recognize that nearly all levered short-volatility trades are simply carry trades in another form, it becomes easier to see how the "Rise of Carry" has come to shape almost every corner of modern markets. Private equity and private debt, for example, operate as large-scale carry trades: they rely on cheap bank financing to amplify the modest spread between borrowing costs and asset returns. As long as conditions remain stable, the PE investor is virtually assured a positive long-term result. Hedge funds function as "agents of carry" as well—using leverage to enhance returns and collecting fees on gains without having to repay losses. If tomorrow resembles today, as it often does, they earn substantial incentive fees; when volatility finally catches up with them, they simply return capital and start over. Even the S&P 500 now exhibits carry-like behavior, as executives—motivated by compensation tied to share prices—capitalize on the spread between low-cost debt and corporate returns by aggressively buying back their own stock.

Carry regimes come with several important quirks. To begin with, they are momentum-driven feedback loops rather than mean-reverting systems. When trillions of dollars chase levered short-volatility trades, both implied and realized volatility are pushed lower—just as a flood of money into a long-Tesla position inevitably drives the stock higher. Carry trades depend on the premise that what has worked will continue to work, which is essentially what low volatility represents. As a result, winners are carried upward: large companies grow larger, growth stocks surge, and value investing is pushed to the sidelines. Value requires the future to diverge from the present—an asset must be mispriced today and eventually be recognized as such. In a carry regime, that recognition rarely comes. Thus growth outperforms value, and large caps beat small caps. Because these regimes thrive in environments of low rates and low volatility, investors naturally assign high values to far-off cash flows and feel comfortable extrapolating strong earnings growth well into the future. Those distant cash flows, in turn, are discounted at low real rates, reinforcing the effect.

Despite their persistence, carry regimes are not the natural state of financial markets. Over long stretches of history, value has consistently outperformed growth and small-cap stocks have outperformed large caps. But those fundamental patterns are often suspended during extended carry regimes. Another notable feature is how much capital these regimes absorb once momentum takes hold. As money pours in, financial assets are pushed far above levels justified by the underlying economy. Whereas financial assets have historically averaged around 75% of GDP, during carry bubbles they can climb to well over 200% of GDP—much as we see today.

During these periods, real assets tend to hold very little appeal for most investors. Why bother with a finite, delineated resource when volatility is low, interest rates are benign, and the market offers a Hyper Scaler that promises to remake the world? As a result, natural resource equities typically struggle in major carry regimes. At best, investors ignore them; at worst, they become part of the short book used to reduce net exposure and make room for more leveraged long positions in winning carry trades. Looking back, we found that every major commodity bear market coincided with a carry bubble. In that sense, this cycle is no exception.

Why own natural resource equities at all? The answer is straightforward: carry regimes are inherently unstable. They persist only as long as conditions allow, and then they unwind abruptly. That was the pattern in 1929, in the 1970s, and again in 1999—and it will be the pattern in this cycle as well.

This naturally raises the question: what brings a carry bubble to an end, and what does the market look like afterward? In almost every instance, the catalyst is a major shift in the monetary regime—something large enough to reset the system and restore balance.

Put simply, a carry regime thrives when tomorrow looks like today; it ends when tomorrow looks markedly different. With so much capital tied to levered short-volatility positions, a meaningful rise in volatility is usually enough to trigger a broad unwind. These are, in effect, two ways of describing the same phenomenon. At the center of it all are the Central Banks.

To see why, it helps to recognize that Central Banks are the primary enablers of carry. In theory, the returns from a carry trade compensate the investor for the risk of a sudden break in the status quo—a spike in volatility, or in equity markets, a crash. But in recent decades, Central Banks have repeatedly stepped in to prevent those breaks. The 1990s saw the "Greenspan put"; the Global Financial Crisis brought "Helicopter Ben"; and COVID led to the United States' first near-direct monetization, with stimulus checks mailed to millions of households. When policymakers reliably cushion markets from catastrophic loss, the incentive to push carry trades for years becomes entirely rational.

For a carry trade to unwind in a lasting way, Central Banks must either be unable or unwilling to operate as they normally do. That can take the dramatic form of a central bank—or its currency—losing credibility, or a more measured form: a major shift in the monetary regime. In practice, a fundamental regime change functions much the same way as a Central Bank that can no longer conduct business as usual.

These shifts are uncommon, but far from unprecedented. Over the past 125 years, they have appeared three times. Every forty years, the monetary world is forced to admit that its prior promises no longer match its present constraints The first came in 1929, when Britain finally abandoned the idea of returning to the classical gold standard at its pre–World War I parity, a system that had been in place since the Napoleonic era. The transition ultimately culminated in the creation of the Bretton Woods exchange system some 15 years later. The second shift arrived in 1971, when President Nixon stunned markets by ending the dollar's convertibility into gold. The most recent occurred after the Asian currency crisis, when many countries broke their dollar pegs and revalued their currencies below market levels to spur exports—an adjustment that led to trillions of U.S. Treasury securities being accumulated as foreign reserves.

Each of these regime shifts brought its corresponding carry bubble to an end. Just as important, each one set off a powerful bull market in resource equities. For years we have argued that the current commodity bear market would end the same way—with a monetary regime change—and we now see more clearly why. A shock of that magnitude breaks the carry cycle and forces a broad rotation out of carry-dependent assets and into whatever had been neglected and under owned. In this cycle, that points directly to resource equities.

We believe we are nearing another monetary regime shift. The current Administration has shown little interest in maintaining the status quo, and both Secretary Bessent and Stephen Mirran have repeatedly pointed to growing global monetary imbalances and the need for a new framework. Earlier this year, the so-called "Mar-A-Lago" accords circulated as one possible approach, though they have recently been overshadowed by tariff proposals. In our view, the two discussions are closely linked, and we would not be surprised to see the topic of monetary regime change return to the forefront. The popular press increasingly refers to this as the "monetary debasement" trade, and headlines appear on it almost daily. At the same time, China continues to expand its official gold holdings, seemingly in an effort to build a gold-backed alternative to the U.S. dollar for international commerce.

Although the exact form of the coming regime change is uncertain, it is increasingly clear that tomorrow will not look like today. And that is precisely the environment in which carry regimes give way.

Lee, Lee, and Coldiron devote several chapters to describing what a post-carry world might look like. They argue that the most likely trigger is persistent inflation—strong enough to limit the Central Bank's ability to counter disruptions by expanding its balance sheet. We largely agree. Although the 1929 carry regime ended in deflation, the scale of recent money creation and the parallels to the 1970s suggest that inflation is the more probable outcome this time.

Perhaps the crisis begins with a failed Treasury auction or a major policy error. The specific catalyst matters less than the pattern that follows. Financial assets that thrived under the carry regime will be the first to fall as leveraged investors face margin calls. Gold should continue to rise, both as a safe haven and as protection against inflation. Oil is also likely to perform well, attracting capital precisely because it was not a crowded carry trade during the bubble. This marks the start of a broad rotation out of high-valuation, high-duration assets that depend on low volatility and into assets with the opposite profile. In this environment, resource equities stand out as one of the few reliable places to protect a portfolio.

And the swing from carry to anti-carry can be dramatic. Ten years after the 1970s carry bubble collapsed, oil companies accounted for one-third of the S&P 500's market capitalization. Commodity stocks were the only sector to deliver real returns over the preceding decade. Exxon and Schlumberger were the two largest companies in the world, together representing about 5% of the index—much as Nvidia does today at roughly 7%. When the Forbes 400 debuted in 1982, roughly one quarter of its members owed their fortunes to the oil business, and those fortunes represented nearly 20% of the list's total wealth. Today, oil wealth makes up less than 6% of the membership and only 3% of the aggregate wealth. Instead, the current Forbes 400 is dominated by technological and financial related fortunes – just as you should expect in the late stages of a carry regime. Together, these industries make up half of the list and represent two-thirds of the wealth. Technology fortunes alone

make up 20% of the list and represent 42% of the wealth. Financial fortunes make up nearly 30% of the list and 22% of the wealth.

As the market shifts from carry to anti-carry, even modest exposure to natural resource equities may be the difference between being added to—or quietly falling off—the 2040 Forbes 400.

In every era, the end of carry has looked less like a gentle turn in the road and more like a sudden clearing of the stage, with new actors stepping into the light. When the script changes, it does so abruptly. And when it does, capital rushes back to the few things with real scarcity, real cash flow, and real value. History's verdict has been remarkably consistent: the moment the future stops resembling the past, the world remembers why it needs resources. And so do investors.

Gold vs. Oil: A Changing of the Guard

We spent the early days of October zig-zagging across New Zealand and Australia, where every meeting seemed to begin—and often end—with the same subject. Gold, gold, and more gold. The fever was unmistakable. With the metal sailing through record highs in 2024 and 2025, investors wanted reassurance, explanation, prediction—anything that might make the ascent feel less like scaling a sheer rock wall without a rope.

For followers of Goehring & Rozencwajg, little of this should have come as a surprise. For three years we had argued—some might say pleaded—that a major gold bull market was approaching. Weakness in the metal or in gold equities, we insisted, was not a warning to sell but an invitation to buy. And those who accepted that invitation were rewarded handsomely.

Back in the fourth quarter of 2022, we were already telling readers that the next leg of the bull market was drawing close. A year later, in our second-quarter 2023 letter, with the turn still nine months away, we imagined a dinner party set in December 2029. Two groups of guests animated the scene. One group toasted their good fortune—faithful accumulators of precious metals. The other sat brooding, their portfolios—stuffed with the great growth darlings of the preceding decade—now offering none of the comfort they once promised. Gold, we wrote, would emerge as the standout asset of the decade, regardless of how the economy or geopolitics twisted around it.

We backed that vision with modeling suggesting materially higher gold prices under almost any plausible financial scenario. And as the bull market finally began stirring in 2023, we emphasized how anomalously cheap gold equities had become—valuations as depressed as anything seen at the depths of the early-2000s bear market. The opportunity was as plain as it was rare.

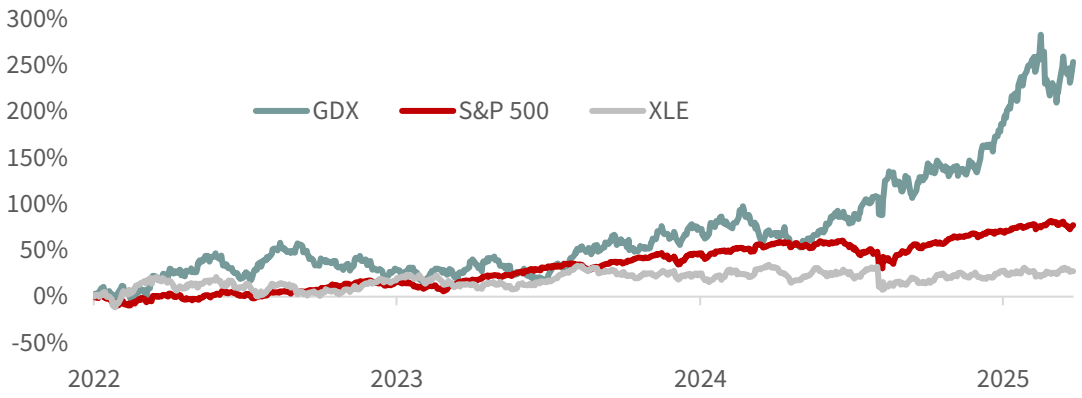
The last three years validated that conviction. Gold—and more strikingly, gold equities—outperformed almost everything else, as any glance at the comparative charts will reveal.

We remain constructive on precious metals and maintain our exposure today. But success also bears a responsibility: to look clear-eyed at the landscape ahead, and to recognize when

leadership in natural resources is beginning to shift.

And now, we believe, that shift is underway.

FIGURE 1 Gold Stocks Outperform (2022-2025)



Source: Bloomberg.

A Familiar Turning: Gold Leads, Oil Follows

In the early 2000s, long before commodities became fashionable dinner-table conversation, a similar baton pass occurred. Gold led the resource market from 1999 through 2003. Then, abruptly and emphatically, oil took over. From 2004 through 2008, crude became the market's leader, and investors who increased their energy exposure were rewarded many multiples over.

The conditions that produced that handoff were not widely understood at the time. Few noticed the subtle but decisive slowing in non-OPEC production. Fewer still appreciated how concentrated the world's marginal supply had become. By the time the market caught on, oil prices were well into their ascent.

We believe the same forces are gathering today. Gold continues to enjoy a powerful long-term setup, and we remain enthusiastic owners. But the balance of opportunity, in our view, is beginning to tilt. This is not a call to abandon gold—it is a call to raise one's exposure to oil.

When Gold Was Left for Dead

To appreciate the present, it helps to remember the late 1990s, when gold had truly become an un-investible asset class. . From its 1980 peak at $850, the metal had slumped for two decades, bottoming at $252 in 1999. Central banks—especially in Europe—were unloading their holdings, convinced that gold had been permanently unseated by yield-bearing assets. This was the era of gold's "demonetization," when bankers spoke confidently about selling down their reserves over 30 years.

The frenzy became so intense that the IMF, nudged by the U.S. Treasury, stepped in to coordinate sales through what became known as the Washington Agreement—an attempt to prevent central banks from front-running one another as they sprinted for the exits.

Producers took their cues from the bankers. Armed with fresh derivative tools and encouraged by the ability to borrow physical metal from the very institutions that were selling it, miners began hedging production years into the future. Barrick famously sold forward 20 million ounces—six years of output. Some Australian producers sold forward more than a

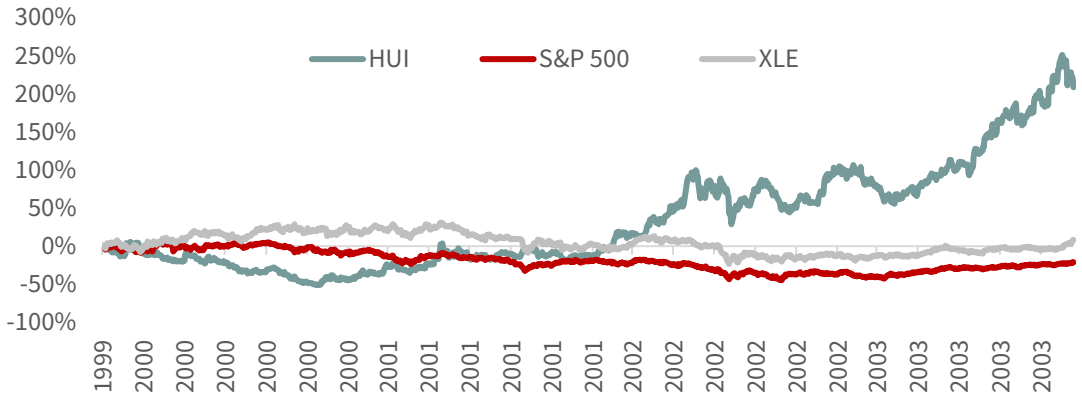
decade's worth of production despite possessing only seven years of proven reserves. It was a strategy that worked beautifully until it didn't. When prices finally turned, companies were crushed under liabilities now exploding in their own hedge books. Barrick's unwind alone cost the company $6 billion—a good portion of the Australian gold mining industry went bankrupt.

And as if central banks and producers weren't flooding the market with enough supply, bullion banks piled on—borrowing gold from central banks and selling into the market ahead of the very producers whose hedges they were arranging.

The result produced an asset that had not only been cast aside but had now become severely mispriced. Measured in what it could buy—including GDP-deflator baskets or even median house prices—gold sat at a historic low. At one point in the early 2000s, an ounce of gold bought fewer than eight barrels of oil, a ratio reached only three times in 170 years.

A few investors recognized the imbalance. In July 2000, Forbes ran a profile titled "Gold at $2,500?", highlighting my view that gold was deeply undervalued. It was an unfashionable view at the time, though ultimately a prescient one. Within a year, gold and gold equities began an extraordinary period of outperformance.

FIGURE 2 Gold Stocks Outperform (1999-2004)



Source: Bloomberg.

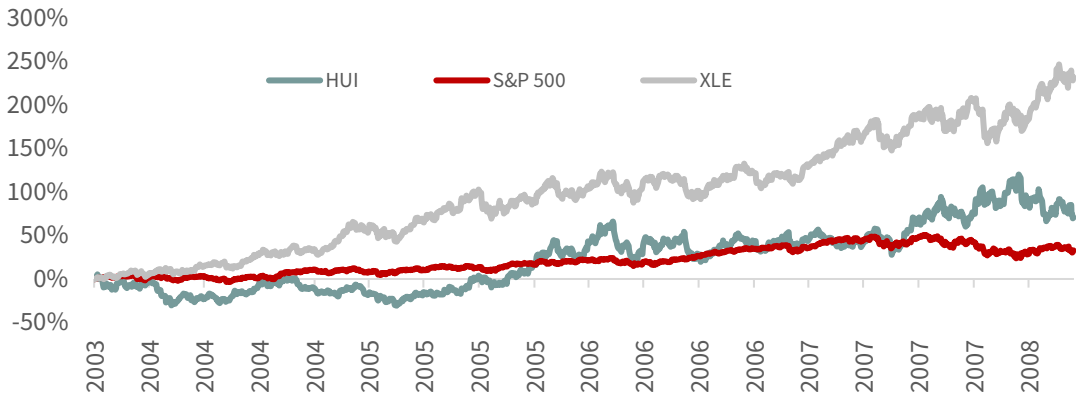
When Oil Took the Mantle

But the wheel turned again. By 2003, oil had become the market's outcast. The Economist 0101emblazoned its October cover with "The End of the Oil Age," capturing the mood of the era—a world reeling from the aftershocks of September 11 and convinced that energy demand was set for terminal decline.

Yet beneath the surface, the seeds of a powerful rally were already sprouting. Non-OPEC supply growth was faltering. Decline rates were accelerating. Spare capacity was shrinking. And as the disconnect between perception and reality widened, oil set the stage for a historic bull run.

In January 2004, Barron's profiled my view that oil prices were poised to rise—not fall—because supply growth was quietly stalling. Within months, the thesis played out. Oil quadrupled over the next four years, and energy stocks led markets with a ferocity rarely seen before or since.

FIGURE 3 Oil Stocks Outperform (2004-2008)



Source: Bloomberg.

What Echoes Today

We recount these episodes not to relive old victories but to remind investors that history often rhymes in natural resource markets. Narratives swing to extremes, supply signals get ignored, and capital flows chase what has already happened rather than what is coming next.

Which brings us to today's fashionable pessimism—this time directed at oil.

For years, the International Energy Agency (IEA) published increasingly confident forecasts that electric vehicles would march inexorably upward and oil demand would soon plateau. Recently, the IEA has softened its language, but the long shadow of those predictions still shapes investor sentiment. Many now accept, almost as reflex, that oil is a shrinking business.

Our research suggests otherwise. In fact, EV adoption—once assumed inevitable and universal—is already showing signs of plateauing in several markets. We believe the long-term growth rate will fall meaningfully short of consensus expectations. Whether or not EVs dominate by 2035 is less important than acknowledging that demand for oil remains far more resilient than the narrative implies.

Meanwhile, oil has undergone the same treatment gold suffered in the late 1990s: declared obsolete, dismissed as uninvestable, and traded down to levels that defy historical comparison. In gold terms, oil has fallen nearly 90% in a quarter-century. As recently as three weeks ago, an ounce of gold bought 76 barrels of oil, surpassed only during the COVID-19 pandemic.*(1)*

In 2004, when the last oil bull market began, the gold-oil ratio stood around 12. Today it is roughly 65. Energy's weight in the S&P 500 has fallen from 6% then to under 3% now. Oil is cheaper and more under-owned than it was on the eve of its last great rally.

At the same time, the supply dynamics that triggered that earlier surge are again coming into focus. Non-OPEC production growth is slowing, and depletion is accelerating in ways that echo the early 2000s. The underlying machinery is familiar—and so is the market's refusal to acknowledge it.

A Rotation in Motion

Put simply: gold remains strong, but oil is stirring. And for investors concerned with relative performance—a crucial constraint for many institutions—the case for raising energy exposure grows stronger by the quarter.

This is not a call to sell gold completely. We continue to believe the long-term prospects for precious metals are robust. But as in 2003, leadership is shifting—and investors who adjust their exposure rather than cling to past winners may once again find themselves rewarded for seeing what others overlook.

Footnote

1. The negative price recorded for the NYMEX May 2020 WTI contract reflected an exchange-level failure to clear positions before delivery constraints became binding. Storage at Cushing was effectively full, open interest unusually high, and forced liquidation produced the now-infamous negative print. Brent, a financially-settled contract, closed at $19.33 on April 21 and offers a truer representation of market pricing. Using that figure against gold at $1,690 per ounce yields a gold-oil ratio of 87 during the crisis.

3rd Quarter 2025 Natural Resource Market Commentary

Commodity prices, having slumped through the spring in a fit of tariff-induced nerves—President Trump's so-called "Liberation Day" duties being the chief provocation—found a touch more backbone as the third quarter wore on. The energy-laden Goldman Sachs Commodity Index managed a 1.3% rise, while the Rogers International index, with its bias toward metals and agriculture, fared slightly better at 2.2%. Both were modest but respectable rebounds from their second-quarter retreats of 4.3% and 3.1%. Natural resource equities, ever the dutiful shadow of the underlying commodities, marched higher in tandem. The North American Natural Resource Index, heavy with energy names, advanced a vigorous 10.9%; the S&P Global Natural Resources Index, more evenly represented with metals and agriculture, was not far behind at 9.2%. In an uncharacteristic moment of parity, both managed to keep stride with the tech-driven aristocracy of the S&P 500 and NASDAQ 100, each of which gained more than 8%.

The patterns sketched so vividly in the second quarter carried over neatly into the third. The precious metals—gold, silver, and the platinum-group cohort—continued their remarkable ascent, and the equities tethered to them outpaced even that. The GDX, the standard-bearer for gold miners, and SIL, its silver-mining counterpart, leapt an astonishing 47% and 49%, respectively. Uranium and its respective equities, apparently unwilling to be left out of the season's enthusiasm, repeated their second quarter strength. Meanwhile, the pall of pessimism that has settled over anything bearing the scent of hydrocarbons remained firmly in place. Crude oil and natural gas, unable to shake the mood, drifted another 4% lower in the third quarter. For the year thus far, oil now stands 13% in the red, and U.S. natural gas 9%. Base metals, grains, and coal offered no such theatrics: their movements were mixed, their trends tentative, as if unsure whether to take the stage or slip back behind the curtain.

Oil

Oil prices continued to drift lower in the third quarter as bearish sentiment reached near-re-

cord intensity. The International Energy Agency's projection of large and sustained surpluses through 2030 has cast a long shadow over the market, and traders have responded in kind. Both West Texas Intermediate and Brent crude slipped another 4% during the quarter, bringing their year-to-date declines to more than 12%. Yet even as the commodities weakened, energy-related equities appeared to steady themselves. The XLE ETF, representing the large integrated companies, rose over 5%, while the XOP, which tracks smaller E&P firms, and the OSX, the widely watched oil-services index, gained 5% and 12%, respectively.

The steady rise in bearish sentiment has had a predictable effect: energy's share of the S&P 500 continues to shrink. It has now slipped below 3% again—reaching 2.7% as we write—a level seen only once before, at the height of the COVID lockdowns in the second quarter of 2020. Measured in gold, oil tells a similar story. On October 20th, one ounce of gold bought 75 barrels of oil, a level surpassed only during the COVID crisis. (As noted in the Gold versus Oil section, we use Brent rather than West Texas Intermediate for historical comparison, since WTI briefly went negative on April 20th. Using Brent, the gold–oil ratio peaked at 87 on April 21st.)

It is remarkable that oil is now approaching this level of relative cheapness. In April 2020, the short-term fundamentals could not have been worse: the world economy was locked down, Saudi Arabia was flooding the market in an attempt to force Russia into coordinated production cuts, and storage capacity was close to overflowing. With collapsing demand and surging supply, oil was being pumped with no certainty it could even be stored. It was, in every respect, a textbook crisis.

As we will describe in the oil section of this letter, today's situation is entirely different. Inventories are falling relative to seasonal norms, demand continues to trend higher, and non-OPEC supply—pressured by growing disappointments from U.S. shale—is slowing rapidly. The widely accepted bearish narrative is simply not showing up in the data. Demand is running well ahead of IEA projections, inventories are failing to build, and the gap between projected surpluses and actual outcomes appears in the IEA's "missing barrels"—oil that is supposedly produced but cannot be found in storage or consumption. These missing barrels are the numerical expression of the divergence between bearish expectations and bullish reality, and they are increasing sharply. We will address this at length in the oil section.

This level of bearishness is not new—and not even particularly old. Sentiment has swung this far before. The most striking example came in October 2003, when *The Economist* grew so convinced of oil's obsolescence that it declared, on its cover, "The End of the Oil Age."

FIGURE 4 Economist Cover

Source: The Economist.

At the time, oil traded at $30 per barrel. Within four and a half years, it had climbed to $145, and energy stocks had become the strongest performers in the market. In the oil section of this letter, we outline why we believe the pattern that began in 2003 is now poised to repeat itself in global oil markets.

Natural Gas

U.S. natural gas remained weak in the third quarter, with Henry Hub prices falling nearly 5%. Forecasts from several prominent meteorology firms had called for an unusually hot summer, but those predictions did not come to pass. By the end of the season, average temperatures were roughly 3% cooler than normal. The cooler weather kept natural gas demand in check and led to a steady, though modest, accumulation of excess inventories. Stocks began the injection season slightly below the ten-year average; by summer's close, they were roughly 150 bcf above that benchmark, an increase of about 4%. This persistent inventory build weighed on prices throughout the third quarter.

Weak prices have once again created a broadly bearish mood around North American natural gas. This persists despite the growing recognition that AI-driven electricity demand will, at least in the near term, be met largely by natural gas, and despite the approaching demand surge from new LNG export facilities. Even so, North American gas prices fell decisively below $3.00 during the third quarter. They remain completely out of step with international prices, which trade in the $10 to $12 per mmbtu range, and with gas's energy-equivalent value relative to oil, which would imply a U.S. price closer to $10 per mmbtu.

We have long believed that U.S. natural gas prices are on a path to converge with international prices, and the case for that convergence is now stronger than ever. Two of the last three winters have been significantly warmer than normal, and delays in three major LNG projects—together representing roughly 6 bcf of new demand, or an increase of nearly 50% from today's 13 bcf-per-day base—have simply pushed the timing of that convergence further out.

Although the timeline has been pushed back, we are more convinced than ever that convergence is coming. We have laid out our view that U.S. natural gas supply is no longer growing and is, in fact, on the verge of declining—a view most natural gas analysts reject. The prevailing belief is that U.S. supply continues to expand at a strong pace, and at first glance the latest EIA 914 data appears to support that. The EIA reports that dry gas production in August reached 109 bcf per day, an increase of roughly 6 bcf per day year over year.

We believe supply should be evaluated differently. U.S. gas shales now account for more than 80% of total production, and a closer look shows that nearly all recent growth is coming from a single field. Every other major shale play has peaked and is now in decline. The table below, which breaks out production by shale basin, makes this clear. U.S. natural gas production reached a short-term peak in December 2023, and as the chart shows, every major play except the Permian has either stopped growing or has begun to roll over—a fact that, at present, virtually no one acknowledges.

FIGURE 5 Shale Dry Gas Production

	12/31/2023	8/31/2025	Difference
Marcellus	27.76	27.42	-0.34
Haynesville	13.34	12.85	-0.48
Utica	6.69	6.42	-0.28
Eagle Ford	4.39	4.23	-0.15
Bakken	2.71	2.74	0.03
Niobrara-Codell	2.76	2.72	-0.03
Woodford	2.67	2.59	-0.08
Mississippi	2.46	2.06	-0.4
Barnett	1.73	1.55	-0.18
Fayetteville	0.86	0.73	-0.13
Rest of Shales	2.76	3.25	0.48
All Shales Ex Perm	68.13	66.56	-1.57
Permian Gas	17.8	20.83	3.07
Total Gas Shales	85.93	87.39	1.5
EIA 914 Dry Gas	105.5	109.1	3.6

Source: EIA.

The chart makes the point plainly: every shale play except the Permian has either stopped growing or has already begun to decline. The Permian is still expanding on the gas side, but as we discussed in last quarter's letter, we believe that growth will slow sharply over the next six months. Oil production in the Permian has already stalled and is now negative on a year-over-year basis. The basin has rolled over—a development that has attracted almost no investor attention—and we expect natural gas production to follow the same pattern.

A series of events over the past three years has pushed the global natural gas convergence trade further out, much to the satisfaction of natural gas bears. The Freeport LNG export terminal fire in June 2022 removed nearly 2 bcf per day of demand for more than a year. That was followed by two unusually warm winters—2022–2023 and 2023–2024—which sharply reduced heating demand and led to large, abnormal inventory builds that put significant

pressure on prices. Now, however, natural gas supply is flattening, a new wave of LNG demand is beginning, and with even average winter weather, we believe it is only a matter of time before North American natural gas moves toward international price levels—which today are nearly four times higher than U.S. prices. For a full review of the underlying fundamentals shaping U.S. natural gas markets, including the early signs of data-center-driven demand growth, please see the natural gas section of this letter.

Gold and Silver

Gold and silver prices continued their strong advance in the third quarter, with gold rising 16% and silver climbing 30%. Precious-metal equities moved sharply higher as well. The GDX, the widely followed gold-stock ETF, gained 46%, while the SIL, its silver-equity counterpart, rose nearly 50%. For the year, precious metals and their related equities have stood out as consistent market leaders. Year-to-date, gold is up more than 45% and silver over 60%, and the equities have been exceptional performers: both the GDX and SIL have gained 125%.

In the short term, gold stands at a crossroads. As we have argued repeatedly, we believe a major shift in monetary policy is approaching—a view not yet recognized or accepted by the broader public, but one for which the evidence is steadily building. The latest surge in gold prices drew a range of explanations, the most common being that gold had become the vehicle for the "monetary debasement trade." We have long maintained that the central objective of any monetary regime change would be to devalue the U.S. dollar relative to hard assets, and that such a shift would show up first and most clearly in the gold price.

Only now are investors beginning to recognize that a monetary regime change may be taking shape. It was the latest surge in gold that finally brought the idea onto their radar. In our view, once investors fully accept that such a shift is underway, gold prices will be much higher—and that will be the appropriate time to sell. We are not close to that point yet.

We do believe, however, that the moment has come to shift a meaningful portion of our gold exposure into oil, a subject we discussed in detail in the introduction. Although the gold bull market is still in its early stages, we think—much as in 2003–2004—that investors will be rewarded for reallocating part of their gold position toward energy.

In the "Gold and Silver" section of this letter, we review the fundamentals now driving those markets: central bank buying (positive), Western ETF flows (positive), silver's relative strength versus gold (still positive), the behavior of GDX buyers (positive), and gold's valuation (still constructive, though certain measures now indicate emerging overvaluation). Each of these topics will be addressed in detail in the Gold and Silver section.

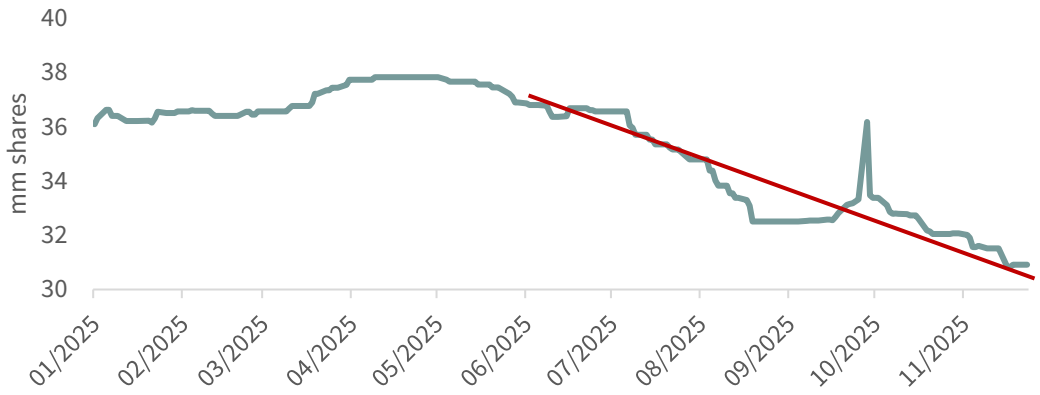
Uranium

"Trump's $120 bn nuclear deal a fresh blow to uranium short sellers" Bloomberg New, October 2, 2025

Uranium prices continued to move higher in the third quarter. Spot prices rose nearly 12%, ending the period at $81.90 per pound. Term prices, as reported by Cameco, also advanced, increasing more than 5% to $82.20. Uranium equities performed strongly as well, gaining 26%. Year-to-date, the URNM ETF—the largest uranium-equity vehicle—is up almost 50%, making it the second-best performing equity group in the natural resource sector.

Despite this strong performance, overall investor interest remains subdued, and speculative sentiment continues to lean heavily negative. As the chart below shows, shares outstanding in the URNM ETF have fallen by nearly 15% since the start of the year—a clear indication of declining investor participation.

FIGURE 6 URNM Shares Outstanding



Source: Bloomberg.

What continues to interest us most is the persistent bearish positioning among hedge funds. In our first-quarter 2025 letter, we noted how short interest in uranium stocks had surged across the hedge fund community, with four of the five most heavily shorted names on the Australian exchange belonging to the uranium sector. Working from faulty assumptions, many funds believed the Sprott Physical Uranium Trust would face liquidity problems and eventually be forced to sell large quantities of uranium into a thin spot market, driving prices sharply lower. On that basis, they built substantial short positions in several uranium names.

We argued at the time that Sprott's liquidity issues were temporary and readily addressed, and we predicted that a significant short squeeze could emerge over the summer. That is exactly what happened: the Sprott Uranium Trust raised capital with ease, triggering a major squeeze across the uranium equities.

One might have expected hedge funds to reconsider their approach after that episode, but the evidence suggests otherwise. As the headline above makes clear, funds have again accumulated sizeable short positions in uranium stocks. The article's opening line is telling: "Investors piled into uranium stocks on Wednesday after the US government unveiled a gold $80 bn plan to build nuclear reactors, delivering a near killer blow to hedge funds betting against the sector."

When the uranium bull market finally approaches its top, we have little doubt that sentiment—hedge funds included—will swing to a wildly bullish extreme. That will be the moment to step aside. For now, with speculators firmly entrenched on the bearish side, it is hard to imagine we are anywhere near such a peak. The uranium bull market still has many years ahead of it, and we take considerable comfort not only in the lack of broad investor interest but also in the hedge fund community's persistent skepticism.

Both the short-term and long-term uranium outlook continues to improve. On the demand side, the positive news keeps accumulating—the U.S. government's announcement this week that it intends to support the construction of ten new Westinghouse AP1000 reactors is only the latest example. But it is the supply-related developments, in our view, that will drive

the next major leg higher in uranium prices.

As we wrote last quarter: "If the demand story is now widely appreciated, the supply story is not—and that may be where the real leverage lies. Several of the world's key growth projects are wobbling… the market's set-up is therefore tightening from both ends: a visible swell in long-term demand and quiet erosion of expected supply."

In the "Uranium" section of this letter, we walk through not only the news supporting demand but also the steadily growing list of negative supply developments. These unexpected supply disappointments will become a major contributor to the uranium market's emerging structural deficit—an issue to which investors, so far, have paid almost no attention.

Copper and Base Metals

A sharp divergence emerged in the third quarter between base-metal prices and base-metal equities, perhaps reflecting investors' hope that the stream of erratic tariff announcements from the U.S. White House might finally be easing. Nothing illustrated that volatility better than what happened in copper. On July 8, President Trump announced a 50% tariff on all copper imported into the United States. U.S. copper prices jumped immediately, reaching a record $5.85 per pound—an extraordinary 30% premium to the London price. Then, on July 30, just one day before the tariff was to take effect, the Administration abruptly revised its plan, stating that the 50% levy would apply only to semi-finished copper, leaving refined metal exempt. The U.S. copper market promptly fell 15%, the largest single-day decline on record. By the end of the quarter, U.S. copper prices had settled roughly back where they began, at $4.85 per pound.

After the turmoil that defined the copper market through much of the second quarter, a sense of calm appears to have settled over both copper and the broader base-metal complex as the fourth quarter begins. Copper prices ended the third quarter down 3.5%. Nickel was essentially unchanged, zinc rose roughly 8%, and aluminum gained about 3%. The real movement, however, was in the equities. A brief lull in the Trump trade-war headlines produced notable strength across copper and base-metal stocks. The COPX copper-equity ETF advanced a solid 33%, and the XBM base-metal ETF, which tracks the S&P Global Base Metals Index, followed with a 26% rise.

We remain short-term bullish. China's rapid expansion of copper smelting and refining capacity has sharply tightened the copper concentrate market, with smelters now bidding against one another to secure supply. Treatment and refining charges have fallen into negative territory—meaning smelters are effectively paying producers to process their concentrate—an unmistakable sign of tightness. At the same time, supply disruptions at two major world-class mines have added upward pressure on prices. Flooding at Ivanhoe Mining's Kakula mine has reduced its expected 2025 output by nearly 50,000 tonnes. In Indonesia, a tragic flooding incident at Freeport's Grasberg underground block-cave operation killed seven miners and forced the shutdown of a significant portion of its underground production. While Freeport has not yet announced when operations will resume, analysts estimate losses of up to 280,000 tonnes of copper in 2025, with an additional 300,000-tonne impact in 2026.

Even with these short-term bullish developments, we must emphasize that the underlying fundamentals of the global copper market have shifted to a decidedly neutral stance. In the

copper section of this letter, we review the short-term factors currently driving prices—including the important point that, after spending the last five years in a slight deficit, the global copper market has now swung back into surplus. We remain constructive in the near term, but our medium- and long-term outlook has become distinctly neutral.

Agriculture

The Northern Hemisphere growing season has wrapped up, the harvest is in, and grain markets have settled back into quiet. Prices were mixed in the third quarter: corn rose 5%, soybeans gained 1%, and wheat slipped 4%. Fertilizer markets showed the same uneven pattern—urea pulled back 10%, phosphates rose 6%, and potash held flat.

As grain prices continue to drift lower, bearish sentiment has surged again. Speculators in the corn futures market have returned to building near-record short positions, betting that prices will fall further. In July, speculative traders were net short 145,000 contracts—the fifth-largest short position in more than twenty-five years of data. This extremely bearish stance is almost a replay of the summer of 2024, when speculators established record short positions not once but twice—first in February and then again in July.

Commercial corn traders, by contrast, have taken the other side. They have built near-record long positions, a classic "smart money" signal that often marks a market bottom. Corn prices did in fact bottom last summer at $3.65 per bushel—down more than 55% from the highs reached following Russia's invasion of Ukraine—and then rallied nearly 40%. Much of that rally has since been given back, with prices now hovering around $3.75.

Given that speculative traders have put on two record and one near-record short positions in just sixteen months—and given that commercials have matched those shorts with near-record longs—we believe the setup strongly suggests a major bottom in the corn market is now in place.

In wheat, speculative traders have taken an equally bearish stance, and commercial traders have again met them with strong bullish positioning. Earlier this year, wheat speculators went 120,000 contracts net short—the second-largest short position in more than thirty years of data. Commercial traders responded by putting on their second-largest long position over the same period. Wheat prices are now more than 65% below their post-Ukraine-invasion peak. With near-record positioning on both sides—speculators heavily short and commercials heavily long—the setup strongly suggests that a major bear-market bottom has likely been reached in global wheat markets.

Soybeans have told a different story. Unlike corn and wheat, they have not produced a convincing buy signal this year. Speculative traders have shown little inclination to build meaningful short positions, and commercial traders have not established notable longs. Positioning on both sides has been largely neutral throughout 2025.

The underlying fundamentals across the three major grain markets have diverged meaningfully. Corn entered the 2025–2026 marketing year in what looked like a relatively tight position. Ending stocks for 2024–2025 had initially appeared extremely high—over 2 billion bushels—and decidedly bearish. But as projected planted acreage came down, demand kept inching higher, and the USDA finally reduced its record-high yield estimate to reflect the subpar 2024 growing season, ending stocks were revised down to just 1.3 billion bushels.

That level sits in the lowest 25% of all ending-stock readings over the past thirty years. With inventories that low, the corn market was highly vulnerable to sharp price pressure should any adverse weather materialize in the 2025 season.

Given our expectation that 2024's hot, dry conditions would repeat in 2025, we anticipated higher corn prices. Several developments pushed against that outlook. Farmers ultimately planted far more acres—boosting corn area by nearly 7 million—and steady summer rainfall reinforced the USDA's high-yield expectations for the 2025 crop. As a result, the USDA now projects U.S. corn ending stocks at 2.1 billion bushels, placing them back in the top quartile of the last thirty years' observations.

Corn prices today stand at about $4.30 per bushel, and we believe there is some downside risk. The last time ending stocks reached these levels—between 2016 and 2019—corn averaged roughly $3.70. We would not be surprised to see prices return to that range.

Soybeans present a somewhat different picture. As with corn, the USDA initially projected 2025 soybean ending stocks at 455 million bushels, placing them in the highest 15% of observations over the past thirty years. But the USDA had overestimated both planted acreage and yields, and it was forced to revise ending stocks down to 330 million bushels—a level squarely in the middle of the historical range and far less bearish. Unlike corn, however, soybean ending stocks for 2026 have actually declined relative to the 2025 estimates. The USDA now expects soybean acres planted in 2025 to fall by 7%, and while this is offset by a projected record yield of 53.6 bushels per acre—up 6% from last year's 50.7—the agency still forecasts 2026 ending stocks at 300 million bushels, roughly 10% below last year. These stock levels are notably less bearish than corn's, which likely explains why soybean traders were far less aggressive on the short side this past summer.

Wheat is more puzzling. Speculative traders have adopted near-record bearish positions even though the USDA projects 2026 U.S. ending stocks at 844 million bushels—only slightly below 2025 levels. At 844 million, stocks are just above the twenty-year average and well below the levels seen from 2015 through 2019. Globally, the USDA expects 2026 wheat ending stocks to continue trending lower; at 260 million metric tonnes, projected inventories sit far beneath the 2015–2019 range. For context, in 2020—before the Russia-Ukraine disruptions—U.S. wheat ending stocks were roughly 850 million bushels, and prices averaged $5.50 per bushel, essentially where they are today. On the numbers alone, wheat traders appear far too bearish given the underlying fundamentals.

At this time last year, the USDA began making substantial cuts to both corn and soybean yield estimates after significantly underestimating the impact of the hot, dry growing conditions on the 2024 crop. We expect the USDA to trim its 2025 yield estimates as well, though not nearly to the degree seen last year—2025 conditions were neither as dry nor as hot.

With the 2025 Northern Hemisphere growing season now winding down, traders have once again turned broadly bearish. In our view, corn still carries some downside risk, wheat has clear upside potential, and soybeans appear neutral in the short term. We had anticipated that last year's extreme heat and dryness would repeat in 2025 and drive grain prices sharply higher, but that expectation did not materialize—weather proved relatively favorable.

Over the next six months, we do not expect much in the way of positive news flow, and grain prices may remain largely range-bound until the next growing season. From peak to

trough, grain prices have already fallen about 50% from their first-quarter 2022 highs, and the bear market looks set to extend a bit further. We added to our fertilizer positions last spring in anticipation of higher grain prices—an outcome that did not come to pass. We remain long-term bullish on the global agriculture complex, as record and near-record trader positioning suggests that major long-term bottoms are forming; but we acknowledge that, in the near term, few bullish catalysts are visible.

Coal

Coal prices showed little movement in the third quarter. In the United States, Powder River Basin, Central Appalachian, and Illinois Basin prices were all essentially flat. International prices leaned slightly lower: Newcastle thermal coal slipped about 3%, and Richards Bay thermal coal fell a little over 5%. Metallurgical coal—the grade used in steelmaking—was similarly steady, with Australian hard coking coal beginning and ending the quarter around $185 per tonne.

Even with coal prices moving sideways, coal equities continued to show notable strength. After rising 25% in the second quarter, coal stocks, as measured by the Dow Jones Wilshire U.S. Coal Index, surged another 70% in the third. Bearish fundamentals in the coal market remain widely accepted by the investment community. The International Energy Agency has again argued that 2025 could mark the final peak in global coal demand.

We disagree with this assessment, as we discussed at length in our previous letter. While we believe coal's long-term future will eventually be overtaken first by natural gas and ultimately by nuclear, we also believe global coal demand will continue to grow into the early part of the next decade. In our view, this creates a meaningful investment opportunity in coal equities. No major global industry has been more starved of capital. Demand for coal is still rising, and supply growth has become increasingly difficult as reinvestment grinds to a halt.

Coal prices have already seen one enormous surge this decade. From their lows in 2020, seaborne thermal coal prices climbed to $450 per tonne after Russia's invasion of Ukraine—three times higher than the previous record set at the end of coal's last major bull market in 2011. We believe another significant price spike remains ahead. The disruption of Russian natural gas supplies in 2021–2022 ignited the last surge; the next one could be triggered by any number of factors.

Investor interest in coal stocks remains minimal, capital spending has collapsed, demand continues to grow, and valuations remain extremely cheap. We have noted many times that coal stocks have been leaders in each of the three great commodity bull markets of the last century, and they have already reclaimed that leadership role. Since bottoming in the summer of 2020, coal equities have strongly outperformed nearly every other asset class—including the high-flying NASDAQ 100. We believe the pullback in coal equities over the past six months has given investors another excellent entry point.

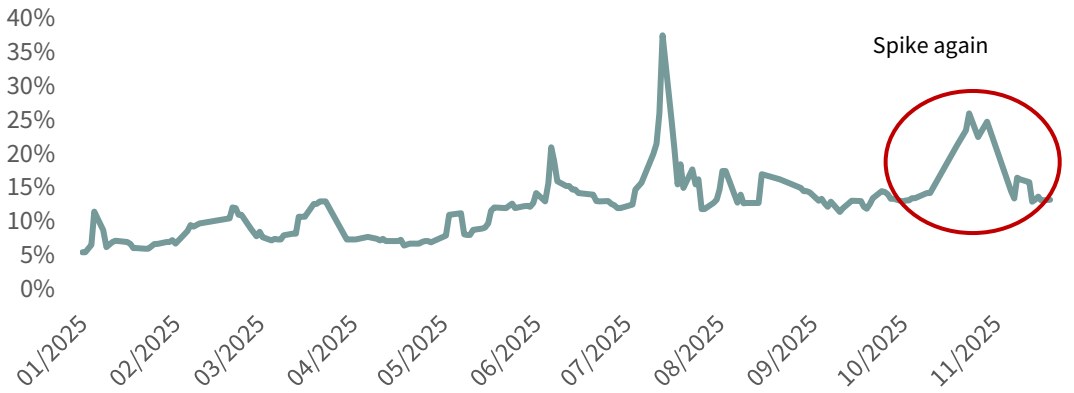
Platinum Group Metals

Platinum-group metals remained exceptionally strong in the third quarter. Platinum, having surged 37% in the second quarter, advanced another 19%. Palladium followed with a 16% gain, while rhodium rose 30%. Equities kept pace. The major South African PGM producers—Sibanye, Impala, and Valterra (recently renamed from Anglo American Platinum)—climbed

an average of 50%. Little in the underlying fundamentals has changed since last quarter. The platinum market remains on course for a deficit approaching one million ounces in 2025—the second consecutive year in which the shortfall has neared that mark. Deficits of this magnitude cannot persist indefinitely; eventually they are curbed by sharply higher prices.

The World Platinum Investment Council now estimates that above-ground platinum stocks will fall below three million ounces by year-end 2025—barely enough to cover three months of demand. In most commodity markets, inventory levels that thin are the prelude to dramatic price spikes. For now, however, short-term forces are working energetically to coax additional supply into the market. Platinum lease rates, which finished last year just under 1%, spiked to 35% in July as the metal completed a 50% price surge. Lease rates have since remained elevated—a clear signal that the scramble for physical supply continues.

FIGURE 7 Platinum 1-Month Lease Rates



Source: Bloomberg.

We should also note that lease rates have surged again, a development that, in our view, reflects the market's steadily tightening conditions. With this renewed spike in leasing costs, we would not be surprised to see platinum prices make another strong advance.

On the supply side, two developments stand out. The first—and one of the most consequential—is the continued slump in recycled platinum, drawn largely from spent autocatalysts. Platinum bears have long argued that recycled supply would rebound to the levels seen from 2019 to 2021, when as much as 1.5 million ounces were returned to the market each year, thereby easing the industry's structural deficit. But the World Platinum Investment Council, in its September update, now takes a different view. For a range of structural reasons, the WPIC believes recycled platinum is unlikely to return to those earlier peaks. For platinum bears, this is yet another piece of unwelcome news.

In earlier letters, we noted that the disappointment in recycled platinum supply was likely to worsen. The reason was the passage of the Infrastructure and Jobs Act in 2021, which mandated that all new vehicles be equipped with passive alcohol-detection systems beginning in 2026. We argued that this requirement would spur additional demand for used cars—lifting their prices—as drivers sought to avoid purchasing new vehicles fitted with these devices. That, in turn, would tighten the supply of junked cars and reduce the volume of autocatalysts available for recycling.

That scenario has now been delayed. The National Highway Traffic Safety Administration

recently announced that it is not yet able to identify a reliable and accurate passive system capable of preventing drunk driving, and therefore the 2026 deadline cannot be met. Mandatory installation has been pushed back to 2029.

We still believe the eventual implications of this law will introduce a substantial new layer of uncertainty into the future supply of recycled platinum—and palladium—from autocatalysts. But the impact will now lie dormant until the end of the decade.

The bullish backdrop for the platinum-group metals remains firmly in place. The recent jump in platinum lease rates back up to 25% is a clear signal that the physical market continues to tighten. PGM prices—and the equities tied to them—have undergone a notable pullback, largely in sympathy with the declines in gold and silver. For investors who missed the first leg of this bull market, we believe the recent weakness in both the metals and the stocks offers an attractive new entry point.

Is the IEA Quietly Turning Bullish?

At Goehring & Rozencwajg, we've built our approach around a simple but often uncomfortable conviction: the best value in natural resource equities is usually found where everyone else has already given up looking. We focus on the sectors that have fallen out of favor, where prices are depressed and sentiment has coasleced into certainty. In these moments, a tidy narrative always emerges to explain the gloom—one that encourages investors to extend today's troubles far into tomorrow. Instead of accepting that storyline, we look for the quieter evidence that supply and demand are shifting beneath the surface. Those early signs usually mark the end of the bear market and the start of the next bull phase, long before the consensus notices.

When this approach works, it tends to work suddenly. The consensus, having grown comfortable with its own pessimism, is forced to reverse course, often violently. Over the years we've noticed a recurring error behind these episodes: investors regularly confuse long cycles with true structural change. Cycles happen all the time; structural shifts, by contrast, are rare enough to practically count on one hand. Mixing them up can be costly—the difference, in many cases, between being swept out in the undertow or catching the turn early enough to earn exceptional returns.

Few markets today illustrate our strategy better than crude oil. Investor sentiment is almost uniformly bleak. The standard storyline claims the world is drowning in supply—shale output that never seems to ebb, now joined by rising OPEC+ volumes. Demand, we're told, is on the verge of rolling over as electric vehicles crowd out traditional consumption. The attitude feels familiar. In 1999, gold was dismissed as a "barbarous relic," a quaint artifact of monetary history with no place in a modern, credit-driven economy. Today, oil carries that same stigma: an outdated fuel from a world supposedly moving on. Gold's obituary, of course, proved premature—it went on to become the best-performing assets of the next twenty-five years. One has to wonder whether oil, now playing the role of the relic, is set up for a similar reversal.

The bearish case today finds its clearest expression in two places—one bearing the weight of officialdom, the other commanding a large online following. The first is the International Energy Agency, which has maintained a gloomy view of oil

markets for years. In its latest Oil Market Report, the IEA describes crude markets as suffering through the worst glut on record. Next year, they argue, will be even worse, with oversupply surpassing the levels reached during the COVID-19 collapse. We take a very different view. The current market looks nothing like that extraordinary period, when inventories ballooned to the point of overwhelming global storage. Today, stockpiles sit at relatively lean levels, signaling balance rather than excess.

During COVID, the IEA's dire pronouncements helped drive sentiment to extremes—and that despair created one of the best investment opportunities we've ever had. Our energy positions purchased during that panic delivered exceptional results. If investors are now reaching for the same pessimism they embraced then, we are more than willing to see how that story plays out a second time.

In the private sector, the role of chief pessimist has largely been taken up by Doomberg, now among the most widely read financial writers on Substack. He has been unwavering in his negative stance on crude, and in recent months he has redoubled it. His reasoning is captured neatly in a passage from his latest essay, "The Cup Runeth Over," where he lays out the mental model he believes investors should adopt:

"Few erroneous concepts [Peak Cheap Oil] have cost investors more capital than this one, primarily because it feels like it should be true. The consensus view is that there is a finite amount of hydrocarbons under the surface, and surely the easiest stuff has already been picked off. As we have consistently argued, a superior mental model is to assume that there is an infinite supply of hydrocarbon resources [ed. emphasis ours], that oil and gas companies are technology superpowers that just happen to produce energy, and that the long-term real price of all commodities is therefore lower."

We debated Doomberg in early 2024 and have not changed our views. The long-term real price of oil has not drifted steadily downward; history shows the opposite. In the 1970s, real oil prices rose more than fivefold, peaking at $106 per barrel (2024 USD) in 1981. As new discoveries came online in the 1980s and 1990s, prices retreated nearly 80%, bottoming at $20.64 by 1999. The industry's underinvestment during that period, coupled with declining output from Mexico and the North Sea, set the stage for the next surge: an all-time real high of $175 per barrel in 2008. The subsequent wave of spending unleashed the U.S. shales, which in turn produced a double-bottom in prices around $35 per barrel in 2016 and again during the COVID lockdowns. Taken together, the pattern is unmistakable. Oil prices do not follow a gentle, inevitable glide path lower. They trace a recurring cycle driven by exploration, development, and the unavoidable reality of depletion.

Second, while hydrocarbon resources are finite—an uncontroversial point—we do not interpret that to mean the world is running out of oil, or that production is about to collapse. But neither does any of this argue for a bearish stance. History again provides the check. In 1970, global output was 48 mm b/d. By 1980, it had climbed to 63 million—a nearly 3% annual growth rate. That increase did nothing to prevent prices from rising fivefold in real dollar terms. When oil bottomed in 1999, production was 71.5 mm b/d; by 2008 it reached 83.1 million, a 2% annual gain. Prices still surged. Indeed, since 1999 the world has produced nearly as much oil as it had in all prior decades combined—an extraordinary accomplishment that nevertheless coincided with real prices trading above $100 per barrel for more than half of the last quarter-century.

In short, oil prices do not rise when the world runs out of oil. Rather, they rise when investors become so bearish that capital is unavailable, and new production ceases to offset base declines. In 1970, it was the decline of conventional U.S. production. By 2003, the pressure points were the North Sea and Mexico. Today, it is the U.S. shales. These cycles repeat with remarkable regularity, and by our reading we are simply nearing the end of a long, grinding bear phase.

The steady drumbeat of negative headlines has taken its toll on investors. Energy now makes up a mere 2.5% of the S&P 500—down from 15% over the last century and 10% over the last twenty-five years, even accounting for prior downturns. Redemption pressure tells the same story. Shares outstanding in XLE and XOP, the two dominant energy ETFs, have collapsed by 42% and 74% respectively since 2022, as investors have rushed to abandon the sector.

And yet, in the middle of all this gloom, several genuinely bullish developments have appeared. The consensus, true to form, filters out anything that doesn't fit its storyline and projects the negative data far into the future. We approach turning points differently. When we make a bold call that a bear market is ending, we look for specific "mile markers"—indicators that confirm we're on the right track. In the past few months, three pieces of fundamental data have surfaced that strongly suggest we are moving in the direction we anticipated.

The Permian Rolled Over

First, U.S. shale oil production turned negative year-on-year in October. We first forecast this outcome back in 2019, arguing that shale output would begin to roll over around 2026. We later pulled that estimate forward to 2025—and events now suggest that call was on target.

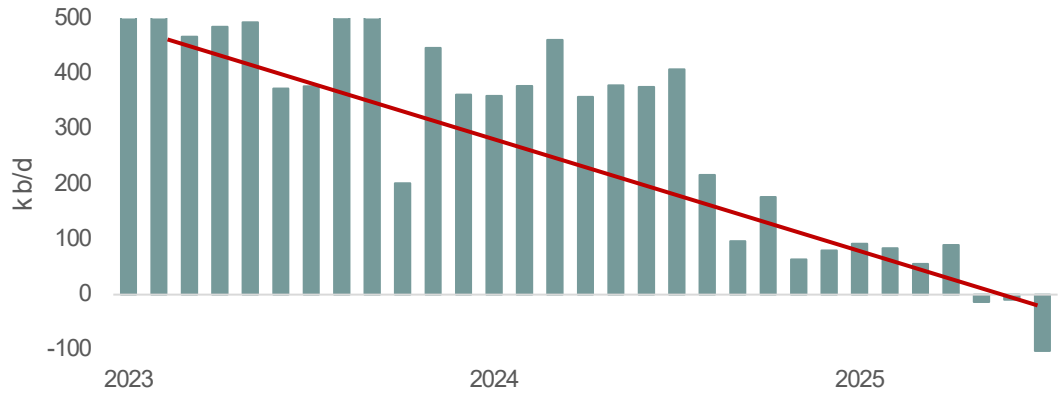
Several years ago, well before today's AI enthusiasm, we built a deep-neural-network model to parse the drivers of shale productivity. That work proved invaluable. The model made clear that most of the productivity gains the industry celebrated were not the result of breakthrough drilling techniques, but rather of something far more prosaic: high-grading. Companies were drilling their best remaining locations first.

Our conclusion ran counter to the industry's preferred narrative, which held that rising productivity reflected better technology. The distinction may sound technical, but it carries major implications. If productivity gains stemmed from true drilling innovation, then the industry had unlocked additional resource and could expect years of continued growth. If, as our work suggested, the gains came from high-grading, then nothing fundamental had changed—the best rock was simply being drilled first, and the remaining inventory was inherently weaker.

Combining this insight with detailed inventory modeling, we projected in 2019 that the Bakken and Eagle Ford were nearing their peaks and that the Permian would top out around 2025. By early 2024, when we debated Doomberg, the Bakken and Eagle Ford had indeed rolled over, while the Permian was still expanding—exactly in line with our timeline. Still, the idea that the Permian might soon peak was treated as heresy, and the debate attracted considerable attention. Doomberg voiced the prevailing view: that technology and engineering prowess would carry the basin forward for decades.

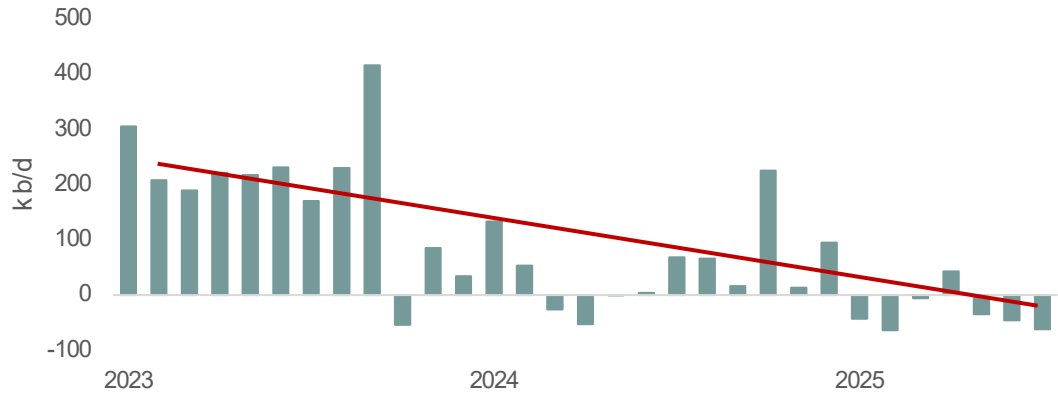
The evidence now speaks plainly: the Permian has rolled. After reaching a peak of 5.73 mm b/d in October 2025, crude output has slipped by roughly 100,000 b/d and has turned negative on a year-over-year basis. This decline in the Permian has, in turn, pulled total U.S. shale oil production down nearly 200,000 b/d compared with last year. None of this resembles a temporary pause. Our models indicate the slowdown is fundamentally geological—rooted in the maturation of the resource—and therefore unlikely to be reversed by incremental engineering alone.

FIGURE 8.A Permian Shale Oil Year-on-Year Growth



Source: EIA.

FIGURE 8.B Other Shale Oil Year-on-Year Growth



Source: EIA.

Although Permian crude production has unmistakably rolled over, natural gas liquids are still rising, and this has led some to question our thesis. But several important distinctions are often missed. NGLs are produced and reported as part of the natural gas stream. In a mixed-medium reservoir like the Permian, this can easily create confusion. As wells age, they become progressively gassier. This means that after a basin hits peak crude output, there is often a transitional period in which gas—and therefore NGLs—can continue to grow even as oil declines. It is simply the result of the production-weighted average well age increasing.

Doomberg points to rising NGL volumes as evidence that total Permian liquids will keep expanding, even while acknowledging crude has peaked. That is a risky conclusion to draw. Our modeling shows that this post-peak gas uplift is brief. If we are correct, year-on-year NGL growth should slow sharply over the next six months, with total Permian liquids—including NGLs—peaking on a sequential basis over roughly the same timeframe. Far from

signaling endless growth, the divergence between gassy wells and falling crude production is typically the last chapter in a mixed-reservoir play—a kind of swan song before the broader decline sets in.

The significance of the U.S. shale rollover cannot be overstated. Over the past fifteen years, nearly 90% of all non-OPEC+ production growth has come from the shales—a larger contribution than U.S. conventional output provided in 1970 or the North Sea and Mexico did in 2003. With such an outsized share of global growth now faltering, the consequences this time are likely to be even more far-reaching.

Oil Demand No Longer Set to Peak?

In its latest *World Energy Outlook*, released on November 12th, 2025, the IEA appears to have made a notable shift in its long-term view of oil demand. Only a year ago, the agency declared with great confidence that the world was nearing peak consumption. Under its "Stated Policies Scenario" (SPS), beginning in 2023, the IEA projected that global demand would rise by less than 2 mm b/d through 2030, then retreat back to 2023 levels by 2035, and finish 2050 some 6.1 mm b/d below where it began.

In the new report, the IEA still presents its SPS figures, though even those have been revised upward—by 1.5 mm b/d for 2035 and 3.8 million for 2050. More importantly, the agency has introduced a new "base case," the *Current Policies Scenario* (CPS). Under the CPS, oil demand grows meaningfully—up 6 mm b/d from 2023—and, crucially, does not peak at any point in the forecast window. By 2050, the IEA now sees total liquids demand approaching 120 mm b/d, compared with roughly 103 million in 2024.

Two factors drove this shift, both of which we've discussed at length in past letters. The first is the IEA's revised view of total global energy consumption through 2050. In our 2023 Q3 letter—particularly in our essay on Jevon's Paradox—we argued that the agency's earlier projections of declining global energy use rested on a deeply flawed methodology. The new report suggests that message may have finally landed. Under the updated scenarios, total energy consumption is now expected to grow by 100–150 terajoules between today and 2040—a dramatic reversal from their previous outlook. Instead of contracting, global demand is now projected to rise at roughly the same compound rate it has maintained since 2010. It's a welcome course correction, though we suspect the eventual figures may still prove higher.

The second driver is the disappointing trajectory of global EV adoption. We have long argued that once you account for the full energy burden of battery manufacturing and renewable power generation, EVs are less efficient at moving people and cargo than widely assumed. That inefficiency, we noted, would limit broad adoption unless governments stepped in with substantial subsidies. Even with those subsidies, uptake has missed expectations. Just this month, Ford announced it would discontinue its highly promoted electric F-150. And much of the recent "EV growth" has come from plug-in hybrids—which still burn gasoline—rather than from true battery-electric vehicles. We expect consumers to remain hesitant for the same underlying reasons, and for future EV projections to continue falling short.

At first glance, the IEA's methodological shift may seem like a footnote, but it carries major implications. Much of the bearish narrative around oil has hinged on the idea of imminent peak demand. Only a few years ago, the IEA's Director General, Dr. Fatih Birol, warned that

any company investing in a new oil project risked owning a stranded asset in a world of permanently declining consumption. He went so far as to advise firms not to approve a single additional project, lest they face future impairments. Under a falling-demand scenario, that position might have had some merit. But if oil demand is now expected to grow for decades, the calculus changes entirely. Companies must reinvest aggressively simply to offset natural declines—and even more so with U.S. shale production beginning to fall.

Production Declines Have Accelerated Materially

Just before publishing the *World Energy Outlook*, the IEA released what we consider the most consequential report in years. On September 16th, 2025, they issued a study titled *Implications of Oil and Gas Field Decline Rates*. The name alone helps explain why it drew almost no attention; it sounds like homework. But beneath that dry heading is a set of conclusions that point unmistakably toward a much tighter global oil market in the years ahead.

They main takeaway is that without any new investment, global crude fields would decline by 8% -- nearly 50% higher than the rate observed only a few years ago. To put this figure into perspective, every year the oil industry must bring on 8 m b/d of new supply simply to offset declines, up from 3.5 m b/d previously.

For the past fifteen years, nearly all of the world's production growth has come from the U.S. shales. In hindsight, the shale boom stands as one of the most remarkable developments in oil industry history. Today, shale output—counting associated NGLs—approaches 15 mm b/d, roughly 50% more than Saudi Arabia's production. Yet for all their scale, the shales are an unusual story. Shale oil wasn't "discovered" in the traditional sense; it was released. The industry always knew where these resources sat, but the rock was too tight to produce economically. That changed only when George Mitchell of Mitchell Energy paired horizontal drilling with hydraulic fracturing, unlocking reservoirs once considered hopeless.

Once Mitchell proved the concept in the Barnett, the industry moved with astonishing speed. Rigs and frac crews multiplied, and the shales were developed with an intensity that conventional fields never experience. In that respect, shale is truly short-cycle. New production can be brought online in months, while conventional oil and gas projects require years simply to discover, delineate, and engineer. The IEA now estimates that a single conventional project can take nearly twenty years from exploration to first oil. By contrast, the shales grew from effectively zero to 15 mm b/d in less time than that.

It's no surprise that the shale boom came at the expense of conventional exploration. Between 2020 and today, the industry has discovered only about 7 billion barrels of oil equivalent per year—down sharply from the roughly 30 billion discovered annually from 2000 to 2010. To put this figure in its proper context, the world consumes 35 billion barrels of oil every year. Development activity has slowed as well. By our estimates, real spending on conventional projects has fallen 35% since 2015. The result is clear: the world has been significantly underinvesting in conventional oil and gas, relying instead on the shales to shoulder almost the entire load.

All of this naturally raises the key question: what happens now that the shales have begun to roll over? The IEA set out to answer exactly that in its latest report, and the implications point to a much tighter market ahead.

The study is remarkably comprehensive, spanning some 17,000 hydrocarbon basins and organizing global output into three buckets: existing conventional fields, new projects, and shale oil. We spent considerable time reverse-engineering their methodology to reconstruct the full production profile over the next quarter century. The results, once laid out clearly, are startling.

At first glance, the report offers a seemingly balanced outlook. If today's annual capital spending of roughly $570 billion holds, the IEA believes global crude production—about 97 mm b/d, excluding biofuels and refining gains—can be maintained through 2050. In a world where oil demand were truly peaking, that might be enough.

But as we've just discussed, the IEA now concedes that demand is likely to keep rising well into mid-century. Under their Current Policies Scenario, consumption climbs toward 120 mm b/d by 2050. To meet that higher level, the industry would need to add roughly 20 mm b/d of new supply—or face a structural deficit. That would require a dramatic increase in investment from today's levels.

The report also leans far too heavily on future shale contributions. By 2035, the IEA assumes that continued investment will lift shale output from today's 15 mm b/d to 18 million. Although they do not spell out their assumptions beyond 2035, our reconstruction suggests they are effectively assuming enough ongoing development to hold shale production roughly flat thereafter. Given what we now know about the geology, that is an optimistic reading—one that risks misrepresenting the true durability of shale supply.

We simply do not believe this outlook is achievable. The U.S. Energy Information Administration projects shale output *declining* by roughly 500,000 b/d by 2035, and by 2 mm b/d between now and 2050. Our own models point to even steeper declines. If so, the IEA may be overstating shale's contribution by more than 4 mm b/d in 2035 and nearly 6 million by 2050.

The report then turns to the critical issue of post-peak decline rates. Once a field peaks, production drops quickly. Without continued infill drilling, the IEA estimates that a conventional field experiences a "natural decline rate" of 8.1% per year. With additional spending on maintenance, infill work, and secondary recovery, that decline can be moderated to 5.9%—the so-called "observed decline rate." But both rates have been rising steadily. Since 2015, nearly 70% of newly sanctioned conventional projects have been offshore, and those fields decline at roughly twice the current global average. Shale declines faster still: absent new drilling, shale output falls 35% in the first year, 18% in the second, and then settles into a roughly 12% annual decline.

This shift toward higher-decline sources has already left its mark. The IEA estimates that annual base declines have risen by 1.5 mm b/d between 2010 and 2025. Less than half of that increase comes from the larger production base. The rest reflects the growing share of shale and offshore output—both of which decline sharply once past their peak. And even if shale slows, the continued dominance of offshore in new project approvals suggests overall base declines will keep drifting higher.

The report then tallies how much new supply would be required simply to offset base declines and keep global production flat. The figures are sobering. Under natural decline rates, output would fall nearly 60%—to about 42 mm b/d—over the next decade. Infill drilling on

post-peak fields helps, adding roughly 10 mm b/d by 2035. Fields that are still ramping up contribute another 5 million, while already-approved but not-yet-developed projects add around 7 million. Unconventional oil—mostly shale—adds 18 mm b/d relative to a world with no new investment, as previously discussed.

Even after accounting for all of these identifiable sources, the report arrives at only 82 mm b/d of production in 2035. That leaves a 17-million-barrel-per-day gap that must be filled by new, yet-to-be-discovered fields. By 2050, the shortfall widens dramatically: the known cohort declines to 51 mm b/d, requiring 47 mm b/d from entirely undiscovered sources just to hold global production flat.

Herein lies the problem. Because a new conventional project can take close to twenty years from exploration to first oil, the industry would need to be exceptionally active *now* simply to balance supply by 2050. The IEA points to roughly 230 billion barrels of discovered but not-yet-approved resources. In theory, these could move more quickly than brand-new finds. In practice, they are expected to contribute only about 13 mm b/d by 2035 and 28 million by 2050. Even after drawing on this entire pool, the shortfall remains large: a gap of 4 mm b/d in 2035 and 19 million by 2050—just to keep production flat.

This leads to three major problems. First, even if substantial new projects were discovered today, they would almost certainly not deliver first oil by 2035, implying at least a decade of structural deficits. Second, the IEA's own math underscores the challenge: adding 19 mm b/d of new supply by 2050 would require discovering roughly 10 billion barrels of new resource each year—about 25% more than the average annual discovery rate since 2020. Third, if demand truly rises to 120 mm b/d by 2050, the world will need an additional 20 mm b/d beyond merely holding production flat. Meeting that requirement would call for roughly 8 billion barrels of fresh discoveries per year, beginning immediately. All of this would demand a massive increase in exploration spending at a moment when most oil companies are still cutting back.

The likely outcome is a prolonged period of tight supply, with a growing share of the market shifting back toward OPEC+. History offers a clear pattern: whenever OPEC's market share rises, so does its pricing power. Taken together, these dynamics point toward a future in which oil prices are not just higher, but structurally higher.

Outlook

Taken together, the two IEA reports—along with the clear rollover in the Permian—reinforce our conviction that we are on the right path. More intriguingly, they may hint at a broader shift in the IEA's long-term perspective. For the better part of twenty-five years, the agency has maintained a consistently bearish view of oil. Any softening of that stance would come as a surprise to a market that has grown accustomed to hearing the same refrain.

If the long-term picture now looks so constructive, why do investors remain so pessimistic? The answer lies in the IEA's short-term *Oil Market Report*, which models balances through 2026. In its latest edition, the agency argues that today's market is in a deep surplus—one that will supposedly worsen next year. According to the report, the current glut rivals the excess seen during COVID, and the coming year's surplus may be even larger.

We see it differently. The issue comes down to the so-called "missing barrels." As we've noted

before, every barrel of oil produced must either be consumed or placed into storage. Yet in the first three quarters of the year, the IEA estimates that global production exceeded consumption by 2 mm b/d—while inventories rose by only about 400,000 b/d. The remaining 1.6 mm b/d simply disappear in their accounting. We refer to these, only half in jest, as the "missing barrels"—oil that was produced, but neither consumed nor stored according to the data.

There are only three possibilities: inventories are being measured incorrectly, supply is overstated, or demand is understated. Historically, it has almost always been the third. Inventory levels are directly observable, and supply numbers are tied to tax and royalty reporting, leaving demand as the usual culprit. We believe that is the case again—global demand is being significantly undercounted.

To be fair, this year's data is somewhat skewed by an increase in oil aboard tankers. Some analysts have suggested that even more crude is "on the water" than reported, implying a quiet return of floating storage. We think the explanation is far simpler. As OPEC+ raised production, the volume of oil in transit naturally rose as well—much like the oil required to fill a new pipeline when it first comes online. We track every tanker loading and discharge globally and see no evidence that vessels are being used as floating storage. The market has been in mild backwardation besides, eliminating any economic incentive for traders to store oil at sea.

Even after adjusting for the additional oil in transit, the "missing barrel" discrepancy still exceeds 1 mm b/d so far in 2026. And there is no sign the gap is closing. The IEA maintains that the surplus will widen further in the fourth quarter. Yet real-time data tells a different story. U.S. inventories—which represent nearly half of all global commercial storage—have risen by only about 200,000 b/d above seasonal norms over the past two months, down sharply from the roughly 800,000 b/d of excess builds seen earlier in the year. The supposed glut is shrinking, not expanding.

According to the IEA's headline numbers, global demand rose by 800,000 b/d year-on-year in the third quarter to reach 105 mm b/d. But if the "missing barrels" are, as history suggests, really uncounted consumption, then adjusted demand did not rise by 800,000 b/d—it rose by roughly 2.2 mm b/d to reach 106.4 m. b/d. The gap between the reported figure and the implied one is striking.

This has major implications for 2026. Based on the IEA's headline figures, demand is expected to grow another 800,000 b/d between the third quarter of 2025 and the third quarter of 2026, reaching 105.7 mm b/d. However, if you believe that demand is actually currently 106.4 mm b/d (as we do), and that it continues to grow by its present 2 mm b/d year-on-year, then it could actually reach 108.4 m b/d by the third quarter of next year – some 2.7 mm b/d higher than the IEA's expectations. Even with these adjustments, the market may still show a surplus next year—but a far smaller one than the IEA portrays.

There are also meaningful risks on the supply side, particularly in the U.S., Russia, and Saudi Arabia. The IEA assumes U.S. production will hold flat through the third quarter of 2026; we think it could just as easily decline by 200,000 b/d. Russia is similarly projected to remain steady at 9.3 mm b/d, though ongoing depletion issues and restricted oil-service support make that number far from assured.

Saudi Arabia remains the real wildcard. The IEA expects the Kingdom to average 10.1 mm b/d next year, a figure we consider optimistic. We have written extensively about the growing strain on Saudi Arabia's supergiant fields, and our analysis suggests the Kingdom struggles to sustain 10 mm b/d without risking long-term reservoir damage. Historically, whenever production has pushed above that level, it has been accompanied by draws on inventories and then followed by pronounced cutbacks to rest the fields. It is too early to make firm predictions, but we would not be surprised if Saudi Arabia announces an unanticipated reduction in output sometime within the next twelve months.

Thus, while the prevailing view—shaped largely by the IEA and echoed by Doomberg—insists that oil markets are drowning in the worst surplus in history, soon to worsen and then slide into terminal decline, our reading of the data points in a very different direction. We see a market that has weathered an unexpected 2-million-barrel-per-day surge from OPEC+ remarkably well, that sits in only a slight surplus today, and that could tip back into a modest deficit by this time next year. Furthermore, the past two years have seen the majority of easily mobilized production vanish – first it was the drilled-but-uncompleted wells in the shales and now it is OPEC+ spare capacity. This leaves very little buffer in near-term oil production.

Beyond that, the fundamentals become even more compelling, driven by rising base-decline rates and steady demand growth—precisely as the only major source of non-OPEC+ supply this decade rolls over.

The great irony of markets is that turning points always look least convincing just before they happen. The data are debated, the narratives feel entrenched, and the consensus leans all to one side—until the floor shifts beneath it. Every great oil cycle ends the same way: with certainty giving way to surprise. The last time investors were this confident in a glut, the market doubled before they understood what had happened. Today's setup is even tighter. We have acted on that reality. Others will move later—when the price has already rewritten the narrative.

Natural Gas: A Research Odyssey

We have long taken a certain perverse pride in conducting research that is not merely original, but occasionally so unfashionable that polite company feels compelled to edge toward the exits. It has led us, more than once, to conclusions that bear little resemblance to the consensus view. Our aim, unfailingly, is to peer just far enough into the future to spot emerging of trends not yet acknowledged—ideally early enough to produce superior investment returns.

This work, needless to say, is neither leisurely nor without hazard. Many market observers prefer the pleasantries of the crowd, where reputational safety lies in numbers. Others make a vocation of narrating yesterday's events and then insisting—with admirable confidence—that they had foretold the entire affair. And then there is the dominant strain on Wall Street: extending today's trends into the indefinite future, as though history were not littered with the corpses of straight-line assumptions.

Our approach attempts—sometimes awkwardly—to stand apart. We recognize that any honest attempt to predict the future must occasionally collide with error. When that happens, as it inevitably will, we try to identify our missteps quickly and adjust. Keynes, with charac-

teristic dryness, put it best: "When the facts change, I change my mind. What do you do, sir?"

We invoke that sentiment now in response to the Substack commentator known as Doomberg, who recently took issue with our expectation that U.S. shale gas production would soon stop growing and eventually roll over.

In January 2024, we debated Doomberg on Adam Taggart's *Thoughtful Money* podcast. During that discussion, we made what was—at the time—a highly unpopular assertion: that both shale oil and shale gas production were nearing their respective peaks. Shale oil was then growing at an impressive 1 million barrels per day, more than half of it from the Permian Basin. We emphasized, almost to the point of repetition, that the Permian was nearing its apex. Few agreed. Yet by October, the basin did the unthinkable—it peaked. Twenty months later, the EIA reports Permian crude output down 100,000 barrels per day year-on-year and total shale oil down 160,000 barrels per day.

In that same interview, we predicted that gas production would follow oil downward, though on a slight delay. That call has aged less gracefully. As we will explain shortly, the error arose from a misunderstanding of the Permian's associated gas behavior—specifically, the way its wells tend to grow gassier as they mature. Outside the Permian, shale gas did exactly what we expected. It rolled over soon after our interview aired and remains down 1.35 bcf/d. Although production has staged a partial rebound from earlier lows, shale gas output beyond the Permian has not reached new highs.

We remain accountable for every call—those that proved correct and those that did not. For that reason, we make all of our old quarterly letters publicly available, allowing anyone to trace the evolution of our thinking. Doomberg has recently done just that, prompting us to revisit several earlier projections.

Two regions deserve special attention: the Marcellus and Permian associated gas—each a dominant contributor to U.S. natural gas supply growth over the past decade.

In our 1Q20 letter, we estimated that the Marcellus would ultimately recover 92 trillion cubic feet of gas. That forecast emerged from a deep neural network built in late 2019 and refined through early 2020—trained to assess ultimate recovery by analyzing where a well was drilled, how it was drilled, and how it was completed. From there, we estimated remaining drilling locations and their expected productive capacity.

Drawing heavily from King Hubbert's teachings on depletion, we observed that hydrocarbon basins often peak once half their recoverable reserves have been produced. Based on that framework, we expected the Marcellus—then producing 23.5 bcf/d and averaging more than 2 bcf/d of annual growth—to peak and roll over in 2021.

History, in its usual wry fashion, had other ideas. We were wrong about the timing. And yet something unmistakably changed in 2021. Productivity, measured as initial production per lateral foot, crested and began to decline. Output continued to rise briefly, eventually reaching a monthly high of 27.8 bcf/d in 2023. But the torrid growth of the preceding decade flatlined. For the past two years, Marcellus production has barely budged.

In 1Q22, we revised our ultimate recovery estimate higher—by 40%, from 92 to 132 tcf. By then, we had significantly enhanced our modeling. We incorporated detailed geological data

that had previously been unavailable and altered the framework in a subtle but profoundly important way. Instead of modeling total well output with lateral length as an input, we normalized production per lateral foot. That simple reframing—removing length from the list of things the model had to "learn"—freed it to capture the real drivers of productivity: geology and completion techniques.

The result was a material improvement in accuracy and a sharp upward revision in estimated recoverable reserves. The facts had changed. So did our minds.

Our revised reserve estimates neatly clarified why Marcellus production managed to keep climbing between 2020 and 2022. Yet with the new figure—132 tcf rather than the 92 tcf we had worked with earlier—we arrived at much the same destination. By 2022, it appeared that within a year roughly half of the basin's recoverable gas would be produced, and growth would cease. This time, the model proved truer to life. In 2023, right on cue, the Marcellus reached its monthly production peak.

The next turn in our thinking came later in 2023. We had begun reexamining how we model undrilled locations—long the most intricate and stubborn piece of the puzzle. Mapping every theoretical wellbore, especially in heavily developed acreage, proved both computationally exhausting and increasingly unsatisfying. So we shifted course. Instead of hunting for individual future wells, we measured the total remaining lateral footage in a given area. Subtract what has already been drilled, apply a representative production profile for that specific neighborhood, and the estimate of remaining recoverable reserves becomes far more tractable. The change nudged our reserve figures higher once again, though not nearly to the extent of earlier revisions.

Our most substantial revision arrived in late 2024, when we retired the deep neural network in favor of a boosted forest algorithm. Accuracy improved once again, but the real triumph was interpretability: we could now see, with far greater clarity, what forces had shaped productivity per lateral foot over time. At the same moment, we revisited how the model treated the later years of a well's life. Shale wells burst onto the scene with extraordinary rates, only to decline sharply—often delivering more than 80% of their ultimate reserves in the first twenty-four months. Because that early flush dominates the economics, we had historically devoted most of the model's attention to it, leaving the out-years somewhat neglected. But then we noticed an unexpected development—the tails were lengthening.

This realization carried two notable consequences. The obvious one was yet another upward revision in recoverable reserves. The subtler, and ultimately more important, was its effect on our understanding of when a field actually peaks. If each well settles into a longer, flatter tail of modest production, total recovery increases, but the timing of the peak does not shift much—because the basin's growth is still governed by those explosive early months. In practical terms, a field may now reach its high-water mark after producing only 35% of its total recoverable reserves, rather than the 50% we once assumed. The peak arrives on schedule, but with far more gas still technically in the ground.

Taking all of these refinements together, we now estimate that the Marcellus will ultimately yield roughly 210 tcf—well above the 135–150 tcf range we projected in 2023. Yet the implication for timing remains largely unchanged. Expecting the field to peak after 50% of 150 tcf has been produced is functionally identical to expecting a peak after 35% of 210 tcf has been recovered. The model is more accurate, the reserves more generous, but the broad

production profile of the basin remains the same.

We have never hesitated to refine our models, nor should any analyst who hopes to remain grounded in reality. But perpetual improvement does not negate the facts on the ground. Something unmistakable happened in the Marcellus in 2023—per-foot productivity declined, and the basin's once unbroken ascent came to a halt. Whatever the refinements in methodology, the underlying explanation, in our view, is straightforward: depletion has arrived.

The Permian Basin is, in many respects, the more intricate—and more captivating—story. Doomberg notes that in 2020 we suggested Permian gas production would soon roll over, and he is correct that, rather than declining, it has since doubled. But the remark deserves its proper setting. In the depths of the COVID-induced oil price collapse, we argued that drilling activity in the oilier reaches of the Permian would inevitably slow, and that associated gas would decline alongside it. We were equally clear that the basin itself had not yet reached its summit. Our expectation then, as now, was that Permian oil—and therefore gas—would likely peak in 2025 or 2026.

Curiously, while Permian oil production did indeed soften during COVID, gas output never paused—it kept rising. The same paradox confronts us today. Oil production peaked twelve months ago, yet gas growth has proceeded undeterred. In hindsight, this revealed a blind spot in our earlier thinking. Our models treated a well's oil stream and gas stream as distinct forecasts. The reservoir, however, does not. The Permian is a true mixed-medium system, with substantial volumes of gas dissolved in the crude—one continuous hydrocarbon cocktail. Underground, pressure keeps the gas in solution, much like carbon dioxide trapped in a sealed bottle of soda. Only once the well is opened does the separation begin.

Once the well is drilled—or, to extend the metaphor, once the bottle is opened—pressure falls and the gas begins to break away from the liquid. Early in a Permian well's life, when downhole pressure remains high, oil and gas travel upward together and only separate at the surface, where conditions are gentler. But as production continues and reservoir pressure declines, the balance shifts. Gas peels off first and flows preferentially up the wellbore. The older the well becomes, the gassier it gets.

Thus, while our neural network did a commendable job estimating each well's ultimate oil and gas recovery, it overlooked a crucial dynamic: as the field ages—not as theory, but as thousands of individual wells—the production mix shifts inexorably toward gas. We had modeled the endpoints correctly, but not the journey.

A typical Permian well may begin life producing roughly 75% oil on an energy-equivalent basis. As it matures, that share can slip toward 45% before leveling off. Which means that as the production-weighted average age of the field rises, the gas-cut rises with it. During periods of rapid drilling, the average age can hold steady—or even decline—masking the shift. But once growth slows and declines emerge, the field inevitably gets gassier. This is precisely what has happened. Over the past several years, the Permian has managed to expand gas output at three times the rate of oil, adding another 1 bcf/d in just the last twelve months—essentially matching its long-term pace—even as oil production has begun to fall outright.

We have taken to calling this episode the great "gas burp." Fortunately, the transition from oil to gas is anything but mysterious. Using a traditional model built on differential equations,

we estimated both the duration and magnitude of post-peak gas growth in a field like the Permian. Our current view is that gas output could still rise by as much as 1 bcf/d over the next 12 to 18 months, before declining in tandem with oil. Given the underlying geology, it is exceedingly difficult to imagine Permian gas continuing to grow far into the future—despite what many analysts still contend.

Making bold forecasts can, at times, test one's patience, but it helps to keep the broader picture in view. Yes, we have adjusted our models and lifted certain estimates, but taken as a whole, the neural network—and now the Boosted Forest—has served us remarkably well. When we first warned of a looming slowdown in late 2019, shale oil output was increasing by an average of 650,000 barrels per day each year from 2008 through 2019. Since then, annual growth has slipped to less than 200,000 barrels per day between 2019 and 2024, before turning negative—down 160,000 barrels per day over the past twelve months. Shale gas outside the Permian tells a similar story: average yearly gains of 4.6 bcf/d from 2008 to 2019 have dwindled to 1.4 bcf/d between 2019 and 2024, followed by a 1 bcf/d decline over the last eighteen months. We freely acknowledge our miscall on Permian gas, but we also believe we now understand the mechanism—and that its growth will slow sharply before rolling over entirely within the next year or two.

Crucially, whatever incremental growth remains in the Permian is likely to be canceled out by declines elsewhere. Other shale basins are already weakening, and their retreat will probably offset most—if not all—of the Permian's gains, leaving total U.S. shale gas production flat at best, and more likely headed lower.

We make no claim to infallibility. But we do believe our work has offered a valuable compass for navigating U.S. energy markets. In many respects, shale gas today resembles shale oil when we debated the issue in early 2024: production was still rising briskly, yet subtle, easily overlooked signals suggested the tide was turning. Within a year, shale oil reached its peak and began to decline. We were proven right then, and we believe we are likely to be proven right again—this time with shale gas.

Turning to balances, as ever, the weather will have the final say as North America settles into the heart of heating season. Inventories now sit 138 bcf above the five-year average—a striking reversal from February, when they were 230 bcf below it. A mild March followed by an even milder summer swelled storage to nearly 200 bcf above average by September, only for an early November cold snap to spur demand and pull gas back out again.

Historically, between November 1 and April 1, storage falls by roughly 1.9 tcf—about 12.6 bcf per day. Should this winter merely mirror last year's—which, it bears repeating, was still 1% milder than normal—withdrawals could easily reach 16 bcf per day, pushing inventories to nearly 300 bcf below average by spring. Against that backdrop, dry gas production is expected to average 108 bcf/d through April, while net exports should average 17 bcf/d, up from 13 bcf/d last winter as new LNG facilities ramp. Remarkably, LNG exports alone appear to have increased by 2 bcf/d over just the past two months. Last winter, consumption averaged 106 bcf/d under slightly milder-than-normal conditions; with incremental data center demand, a repeat could nudge that figure to 106.5 bcf/d. Add it all together, and inventories could draw by as much as 2.3 tcf this season—tightening relative storage levels by roughly 400 bcf.

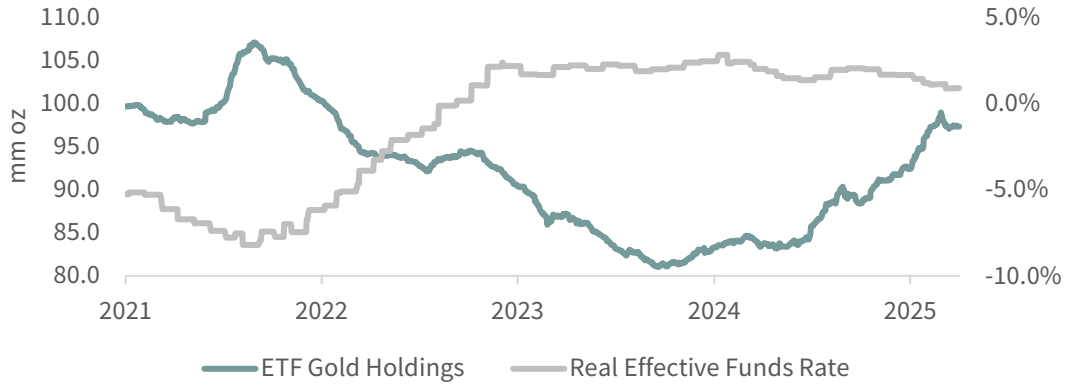
Looking beyond winter, the arithmetic becomes increasingly uncomfortable. Rising LNG

exports, growing data center demand, and largely stagnant shale supply make it hard to imagine inventories not beginning a steady drawdown relative to long-term norms. Weather will still have its say, of course, but the setup is already taking shape. And so one must ask: how much longer can U.S. natural gas trade at a 60% discount to global prices? The gas bull market may finally be upon us, though one suspects most investors will recognize it only after the price screens have already done the shouting.

Precious Metals: Bright Days Lie Ahead

Short-term forces continue to tilt favorably across global gold markets. Chief among them is the persistent—and frankly striking—resurgence of Western buying appetite. The eighteen physical gold ETFs we monitor, a sort of modern barometer of investor conviction, have not merely held their ground but continued to draw bullion into their vaults. In the third quarter alone, these funds absorbed nearly 200 tonnes of physical gold. Behind this renewed Western enthusiasm lies the old, reliable lodestar of gold demand: the path of real interest rates, a subject we have discussed more than once in these pages. And the relationship is on vivid display today. Over the past two years, as real yields began their sharp descent, investors in the West—acting through these very ETFs—began accumulating gold in earnest. We view the timing as anything but accidental.

FIGURE 9 Gold ETF Holdings vs. Real Effective Fed Funds Rate



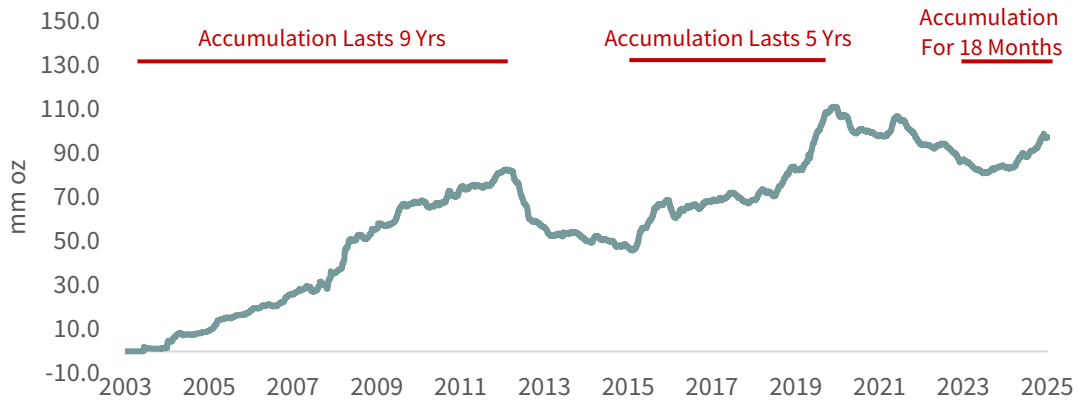
Source: Bloomberg.

We believe President Trump will ultimately succeed in pressing interest rates lower, that inflation is moving higher, and that we have entered a longer cycle of declining real rates—conditions that can only deepen Western investors' interest in gold. In our last letter, we outlined how this interplay between Trump, the Federal Reserve, and rising inflation would unfold. Thus far, events have begun to progress very much in line with that earlier view.

We also believe that Western gold buying is still in its early innings. If recent history offers any guidance, this phase could run for years—particularly if we are indeed entering a prolonged period of falling real interest rates. The chart makes the pattern unmistakably clear: over the last twenty years, we have lived through two major cycles of physical gold accumulation, each driven by declining real rates, and we now appear to be at the opening of a third.

The first cycle began in late 2004, when GLD—the SPDR Gold Shares—first came to market. That wave of buying continued straight through to the end of 2012, an eight-year run. The second began in early 2016 and carried on for five years. By contrast, the current cycle only began in the summer of 2024 and, so far, has been underway for less than a year and a half.

FIGURE 10 Gold ETF Accumulation Trends



Source: Bloomberg.

Beyond the West, gold accumulation through Eastern ETFs also remained active in the third quarter. Of the three major markets we follow, two were net buyers: Indian ETFs added 11 tonnes, and Japanese ETFs purchased 6 tonnes. China had been a substantial buyer earlier in the year—its ETFs accumulated nearly 65 tonnes in the first six months—but reversed course in the third quarter, selling 6 tonnes.

We believe the convenience of purchasing gold through ETFs is now being quickly recognized by Eastern investors, and that this development could become an important new source of global gold demand.

The eight physical silver ETFs we track tell a broadly similar story. As the chart shows, these funds began accumulating silver in the summer of 2024, moving in step with their gold counterparts. Yet there is an important nuance worth emphasizing. The current rise in silver ETF holdings marks the early stages of an accumulation phase, and in our view that is a constructive signal—it reinforces the sense that the gold bull market is gaining momentum. What we do not want to see, however, is a repeat of the speculative surge in silver that erupted in April 2020, which is clearly visible on the chart.

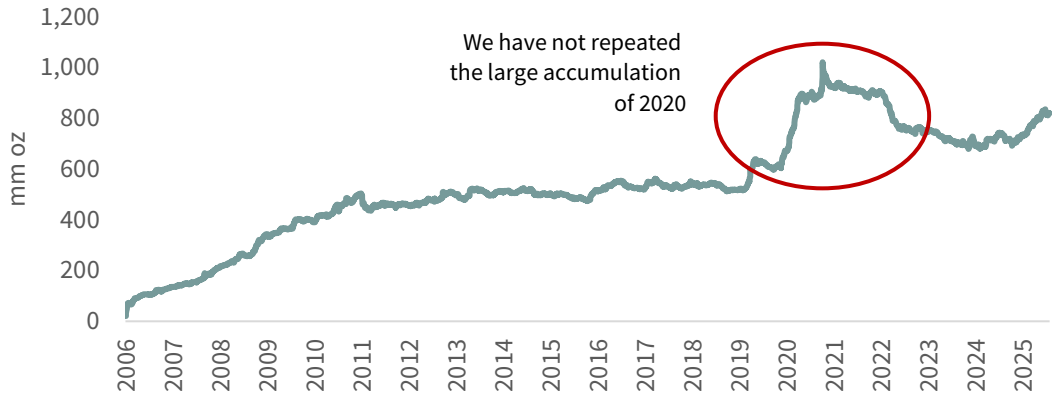
As we have noted in earlier letters, one of the clearest signs that a gold bull market is nearing its end is a dramatic, speculative catch-up rally in silver. That is precisely what unfolded in the spring of 2020, and the speculative mood was unmistakably visible in the behavior of the physical silver ETFs at the time. Today, despite frequent claims of silver shortages and sharply rising lease rates in London, we see very little evidence of that kind of speculation in the ETF data. The contrast with the summer of 2020 could hardly be more pronounced.

And, as we will discuss shortly, the relatively subdued pace of accumulation in these ETFs suggests to us that the current bull market in gold is still in its early stages—not approaching its conclusion.

Another major positive for the gold market is the continued strength of central-bank buying.

The World Gold Council estimates that central banks purchased 220 tonnes in the third quarter—a 28% increase from the second quarter and a 10% rise from the third quarter of 2024. Year-to-date, central banks have added 634 tonnes, a pace only slightly below that of the past three years.

FIGURE 11 Silver ETF Holdings



Source: Bloomberg.

Emerging-market institutions again figured prominently in the third quarter, but there were some notable new entrants as well. Brazil and Kazakhstan, for example, bought 15 and 18 tonnes respectively. Both countries are significant trading partners of China and now settle a meaningful portion of their trade with China in renminbi. We have long suggested that imbalances in this trade could eventually be settled in gold—outside China's closed capital account—and it is sensible, in that light, that both nations continue to build their gold reserves.

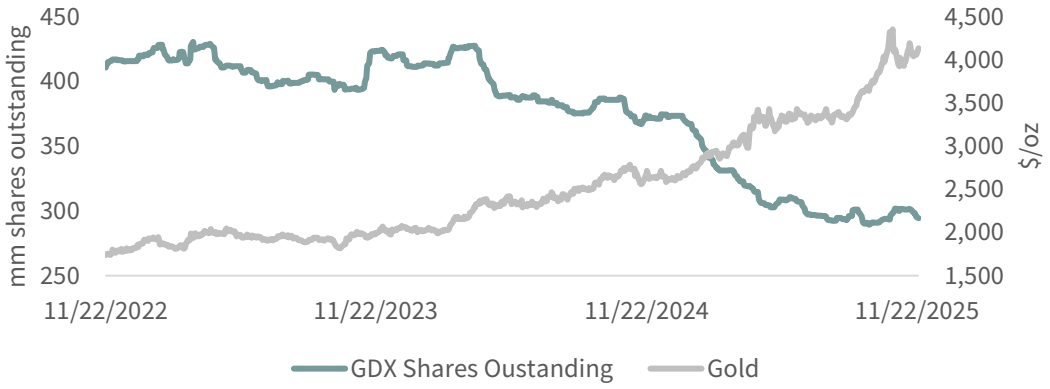
China also remained a buyer of gold, though at a much calmer pace—purchasing 5 tonnes during the quarter. While China has markedly slowed its gold buying, it continues to accumulate steadily. A notable absence from the third-quarter data, however, was the National Bank of Poland (NBP). The NBP has been the largest buyer of gold in 2025, adding nearly 70 tonnes earlier in the year. Its stated objective had been to raise gold to at least 20% of its reserves, and by the end of the second quarter it had reached 24%. That achievement likely explains its temporary pause. But the pause may not last long. The NBP has since announced a new target: increasing gold to 30% of its reserves. With total reserves of $265 billion, this goal implies the bank may return to the market for roughly 120 additional tonnes of gold at today's prices.

Given the Trump administration's repeated calls for both lower interest rates and a weaker dollar, Western investors are only now beginning to embrace gold as an effective way to protect—and even profit—from this policy direction. Central banks, by contrast, recognized this dynamic long ago. They understood earlier than most that the most reliable hedge against declining U.S. rates and a depreciating dollar was to keep adding to their gold reserves. We believe they will continue to pursue that strategy.

Western investors continue to accumulate physical gold, and central banks remain steady buyers as well. Yet one asset class they persistently avoid is gold equities. This is all the more striking given that gold stocks have been, by a wide margin, the best-performing asset class over the past two years—outpacing both the S&P 500 and the tech-heavy Nasdaq 100 by

nearly three to one. Despite this exceptional performance, investor interest has remained almost nonexistent.

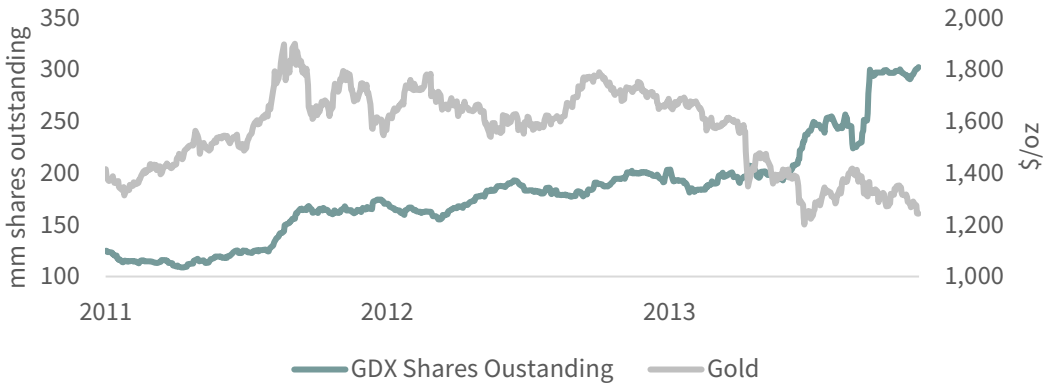
FIGURE 12 GDX Shares Outstanding (2022-2025)



Source: Bloomberg.

As the chart makes clear, shares outstanding in GDX—the most widely used gold-stock ETF—continue to trend downward. Investor interest in gold equities has been fading for nearly five years, and what strikes us is that the decline in GDX share count accelerated just as the physical gold market was breaking out. Rather than buying into the bull market, gold-stock investors have taken gold's rising price as an opportunity to sell. Paradoxical as it may seem, selling into an emerging bull market is often a constructive signal: it suggests that investors in the sector have very little confidence in the durability of the move. This stands in sharp contrast to the behavior of gold-stock investors during the 2010–2013 period.

FIGURE 13 GDX Shares Outstanding (2010-2013)



Source: Bloomberg.

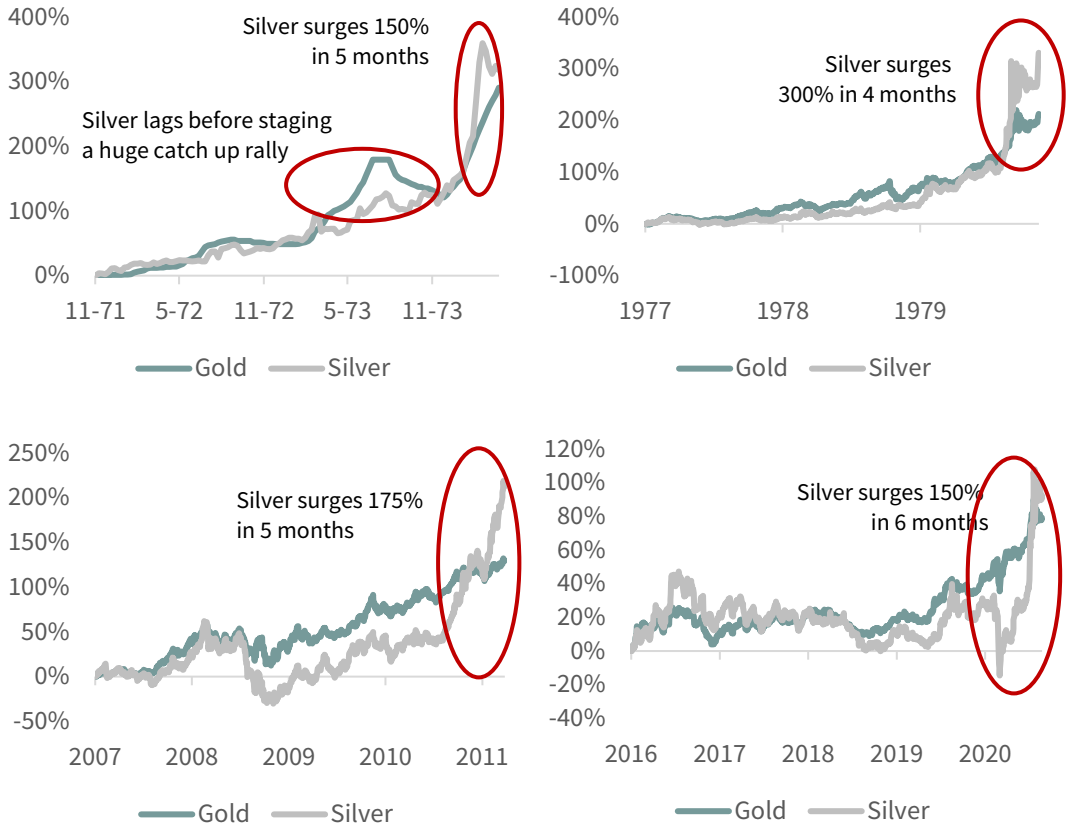
Gold had been in a sustained ten-year bull market, and as the chart below shows, investors continued to pour into gold stocks just as the market was peaking and about to enter a severe four-year correction. Before this current cycle is finished, we are highly confident that interest in gold equities will surge again and that the number of shares outstanding in the GDX ETF will climb sharply—much as it did in 2010. When that happens, it will serve as an important signal that the gold bull market is nearing its end. For now, however, we are nowhere close to that point.

We also think it important to address silver and its recent price behavior. Silver lease rates spiked in October—briefly reaching 35%—as talk intensified about shortages of physical metal in London. Historically, bouts of intense speculation in silver and sharp, outsized price moves have tended to occur near the end of gold bull markets. This naturally raises the question: does silver's recent rise signal that the current bull market is nearing its end? Are we about to see a correction in gold prices, similar to what unfolded in the fall of 2020?

For the past fifty years, every major gold bull market has ended the same way: with a dramatic surge in silver. Once that surge occurs, gold—and gold equities—have invariably faced significant pullbacks. At times, these retreats have merely been corrections within a larger bull market; at others, they have marked far more consequential reversals.

There have been four such episodes: 1973–1974, 1979–1980, 2010–2011, and 2020. In each case, silver lagged the rising gold market for as long as two years before erupting in a furious catch-up rally.

FIGURE 14 Silver Catch-Up Rallies



Source: Bloomberg.

Across the four major episodes, silver's catch-up rallies averaged between 150% and 300%, and each one has served as a clear warning that a substantial correction—or a full-fledged bear market—in gold was close at hand. After the 1974 surge, gold fell 45% and gold stocks nearly 70%. Following the dramatic 1979 rally, gold stocks entered a grinding twenty-year bear market. From peak to trough, gold prices dropped more than 70% and gold shares by 80%, while the broad stock market rose almost fifteen-fold. After the 2010 catch-up rally,

gold prices declined 45% and gold equities fell 85%. And after the most recent episode in 2020, gold slipped 20% and gold shares more than 50%.

In the current cycle, there has been no shortage of commentary about spiking silver lease rates, traders scrambling for supply, and a looming short squeeze in London. Yet silver itself has not delivered the sort of catch-up move that has historically marked the end of a gold bull market. After lagging gold for two years, silver has rallied only about 50%, and even now remains behind gold's performance. Had silver staged a dramatic move—something on the order of at least 150%—we would be urging investors to exit their gold and silver positions, just as we did in the summer of 2020.

FIGURE 15 Recent Trends

Source: Bloomberg.

Instead, silver's behavior, or lack thereof, signals to us that the gold bull market remains intact and that another meaningful advance still lies ahead. A large speculative run in silver will almost certainly occur before this bull market ends, but we are nowhere near that point. Indeed, when this cycle eventually reaches its peak, we would not be at all surprised to see the reappearance of someone attempting to corner the silver market—much as the Hunt Brothers tried to do in 1979. For all the talk of soaring lease rates and tightening supply, silver's price action remains relatively subdued, reinforcing our conviction that the gold bull market has much further to run.

Gold now trades at more than $4,100 per ounce—up 300% from the $1,050 low reached in December 2015 and nearly 125% above its prior bull-market peak in 2011. In past letters, we have discussed at length the potential price targets for gold and the range of outcomes this bull market could deliver. With gold having clearly entered a new upward phase, we think it is worth revisiting how high prices might ultimately carry.

Our view remains that this bull market is still in its early stages and has years yet to unfold. Even so, some of the valuation measures we monitor have begun to flash outright sell signals, while others remain firmly in bullish territory. What follows is a review of the key valuation parameters we are watching most closely.

Gold vs. US Monetary Base - Very Bullish

Viewed against the size of the U.S. monetary base, gold still sits at a level that can only be called inexpensive. The comparison is a familiar one, and history gives it a certain bite. On two earlier occasions—1937 and again in 1980—the dollar value of the Treasury's gold

holdings rose to one and a half times the Federal Reserve's monetary base, a sort of fever chart of the country's monetary anxieties. Today, by contrast, those same holdings amount to barely 18% of the Fed's base, a figure so low it almost invites a raised eyebrow.

If markets were merely to return to a historically reasonable equilibrium—say, a 100% coverage ratio even after excluding the Fed's excess reserves—the implied gold price lands comfortably above $10,000 an ounce. And should sentiment or policy eventually push conditions back toward past extremes, the upside could be dramatic, with gold approaching $30,000 per ounce. By this measure, substantial runway remains.

Gold vs. M2 - Bullish (and indicative of a collapsing money multiplier)

Measured against a broader definition of money, gold appears less of a bargain but hardly expensive. At today's levels, the Treasury's gold holdings amount to roughly 5% of M2. When gold last reached an emotional peak in 1980, that figure stood at 11%. We lack formal M2 data for 1937, but reasonable reconstruction puts the ratio then at nearly 12%. By that yardstick, gold would need to trade around $9,000 an ounce to revisit comparable heights.

The gap between this analysis and the far more dramatic monetary-base comparison owes much to the simple fact that the money multiplier—M2 divided by the monetary base—has collapsed in recent years. The reason for that collapse lies outside the boundaries of this brief discussion, though one suspects it has no small connection to the carry bubble now enveloping the markets. Should that regime come to an end—as we believe it will—the multiplier could well normalize. M2 would rise accordingly, and the gold price required to reach those earlier valuation extremes would rise with it.

Gold vs. the Dow Jones - Bullish

When set against equities, gold continues to present a distinctly favorable silhouette. The long-cycle relationship between the two still leans toward further gold outperformance, and history offers its own reminders. Twice in the past 125 years, the price of the Dow Jones Industrial Average and the price of gold have met—or all but met—on common ground. In 1932, the Dow sank to 40, and the government raised the gold price to $35 an ounce the following year. On January 21, 1980, they crossed outright at $850.

We have long believed that such a meeting will occur again within our investment lifetime; the only unresolved question is the level at which the Dow will be waiting. The crossing, if it comes, will almost certainly occur during a sharp equity decline. How far could stocks fall? In 1980 the Dow traded at book value, and today that book value stands near 8,000. Using that as a kind of floor—an uncomfortable but historically defensible worst-case scenario—one can still argue that gold has room to double from present levels before reaching parity with the index.

Gold vs. Residential Real Estate — A Cautionary Contrast

When measured against residential real estate, gold tells a far less comfortable story. Housing prices anchor this ratio at levels that, historically, have not proved durable for long. In the late 1930s—one of gold's great periods of overvaluation—it required roughly 100 ounces to buy the average American home, then priced around $3,500. In 1980, gold's other moment of extreme enthusiasm, the figure was about 95 ounces. Even at the height of the 2011 bull

market, the ratio fell to 120 ounces. Today, with gold above $4,100 an ounce, the number has returned to roughly 100 ounces per average house—squarely in line with the valuation peaks of the late 1930s and 1980. By contrast, during periods of true undervaluation—most notably the late 1960s and again in 1999–2000—it took nearly 700 ounces to purchase the same average home. On this measure, gold is as expensive as at any point in the last 125 years, and the implication is hard to ignore: its remaining upside, viewed through this particular lens, may be limited.

Gold vs. the GDP Deflator — Bearish

Another way to assess gold's standing is to measure it against the broad price level of goods and services. The St. Louis Federal Reserve's real GDP deflator, which tracks such a basket, extends back to 1947. With the deflator now at 128.25, gold trades at roughly 33.2 times that figure. By historical standards, this is stretched. The ratio is nearly 50 percent above its 1980 peak of 22.4 times and well beyond the 19 times reached in 2011. In both earlier cases, the elevated readings coincided with the end of their respective gold advances.

Gold Deals — Bearish – but strange.

New issuance in the gold sector has surged this year. Thus far, 2025 has produced 914 IPOs and secondary offerings, raising a combined $17.6 billion—an amount that already surpasses the previous record set in 2009. As a rule, we are more comfortable investing in industries other investors shun; a crowded new-issue calendar usually signals quite the opposite.

What makes the present moment unusual is the contrast. Capital is flowing freely into these deals at the very time investors are withdrawing from the major gold-equity ETFs. The two signals do not typically coexist. For now, the question of who is funding this burst of new issuance remains unanswered.

Viewed as a whole, these indicators offer a mixed but revealing picture. Against the great financial aggregates—the monetary base, M2, and equities—gold still appears undervalued. Measured against the prices of goods and services, however, gold stands as expensive as at any time in the modern record. The contrast points to a deeper current running through today's economy: its extraordinary degree of hyper-financialization. Financial assets have been climbing far faster than the non-traded world beneath them.

In our view, this divergence is one of the signature features of the carry bubble now dominating economic behavior. As noted earlier, carry regimes often produce precisely this pattern: equities inflating to more than 200% of GDP, compared with a long-term average near 70%, and money multipliers sinking to levels that make the monetary base and M2 appear to inhabit different universes. The inconsistency between those two measures fits neatly within that framework.

We believe the carry bubble will not end quietly. A monetary regime change—marked by persistent volatility and more stubborn inflation—seems the more likely terminus. In such an environment, one would expect money velocity to recover, lifting M2, while equities deflate and the prices of housing and goods rise. A shift from carry to anti-carry would, in effect, draw many of these metrics back toward long-ignored historical relationships.

The remaining question, naturally, is where this leaves gold. In a setting where confidence in the dollar begins to fray, one would expect gold to move higher, just as it did in 1932,

1969, and again in 1999. Yet we must also allow for the likelihood that some assets may fare even better as they normalize relative to gold. Chief among them is crude oil, which now trades at one of the cheapest levels in its history when measured against gold.

Gold investors are likely to find themselves well rewarded by the end of the decade. Oil investors, we suspect, may be even happier.

Problems Developing With Uranium Supply

Global uranium markets have been awash in bullish developments over the past two years, as governments, utilities, investors, and even long-skeptical environmental groups have begun casting aside the narratives that constrained nuclear power for four decades. After years of stagnation—during which global generating capacity failed to recover from Fukushima—it was only in 2023 that nuclear output finally crept past its 2010 peak. Today, the outlook for nuclear power looks radically different.

In its newly released *v*, the World Nuclear Association (WNA) lays out a series of projections based on its assessment of global nuclear trends. From a 2025 base of 398 GWe of installed generating capacity, the WNA's base-case scenario now expects capacity to reach 746 GWe by 2040—an increase of roughly 90% from today's levels. Notably, that 746 GWe estimate represents an upward revision of nearly 10% from projections made just two years ago.

The WNA has also raised both its lower- and upper-bound forecasts. Its low-case scenario now calls for 552 GWe by 2040, an increase of 66 GWe over the 2023 outlook. Its high-case scenario has risen to 966 GWe, up 35 GWe from the prior estimate. Even under the WNA's most pessimistic projection, global nuclear capacity is expected to expand by at least 40%.

On the uranium fuel side, the WNA now expects global reactor requirements to total roughly 179.1 million pounds this year. (It is worth noting that this figure sits nearly 3% above the already-bullish 177 million pounds of demand we ourselves projected just four years ago.) Under its base-case outlook, the WNA estimates that reactor demand will reach 330 million pounds by 2040—an extraordinary 90% increase from today's levels.

In its upper-case scenario, the WNA projects reactor demand could rise to 530 million pounds, a truly immense expansion. Even the most conservative projection puts 2040 demand at 278 million pounds—almost 100 million pounds more than current consumption.

Given these enormous growth assumptions, the expansion of uranium supply over the next fifteen years will be critical. And on that front, the challenges are already beginning to surface. The supply problems emerging today will only deepen the structural deficits now developing in global uranium markets.

The uranium market in 2025 has already fallen in deficit when investment demand is included, and we believe uranium markets next year will slip into outright operating deficit. We estimated uranium mine supply in 2025 will reach 160 mm pounds, secondary supply will approximately 25 mm pounds, and investment demand will approach 10 mm pounds—producing a deficit of 5 mm pounds. For 2026 we estimate both uranium mine supply to be down and reactor demand to be up, producing an outright deficit in global uranium market before investment demand is factored in.

Problems are emerging on several fronts. In Kazakhstan, the eastern anchor of global uranium supply, Kazatomprom—the world's largest producer—continues to struggle with its production expansion plans. After the sharp rebound in uranium demand in 2022, the company announced an ambitious target: an 11-million-pound increase in output, roughly a 20% rise. Then, in September 2023, Kazatomprom went further, outlining plans to lift 2025 production by an additional 12 million pounds, potentially bringing total output to 80 million pounds by utilizing 100% of the subsoil exploitation rights granted by the Kazakh government.

We met with Kazatomprom in Almaty in June 2024 and left with the clear impression that the company's production guidance would need to be revised downward. Earlier that year, in a surprise announcement, Kazatomprom had already cut its 2024 production estimate by 10 million pounds. Yet at the time of our visit, management continued to maintain its 80-million-pound production target for 2025.

Much of the blame for the 2024 reduction had been attributed to shortages of sulfuric acid. But in our view, far deeper production issues were embedded in the company's massive Budenovskoye 6 and 7 greenfield developments—projects beset by both political complications and geological difficulties.

Original plans called for the Budenovskoye projects to produce 13 million pounds of uranium by the end of 2025. After our visit, we came away with the strong conviction that this target was unattainable—a view we explored in detail in our essay *"Uranium: A Drama in the Making,"* which is readily accessible online.

In a development that stunned the uranium analytical community, Kazatomprom announced in September 2024 that it was cutting its 2025 production forecast from 80 million pounds to 69 million—a reduction of more than 10 million pounds.

The company has offered little insight into what is happening at Budenovskoye, but it is difficult to escape the conclusion that the bulk of the shortfall stems from organizational and construction delays at the project.

The disappointments have not stopped there. On August 22, the company revealed that it was reducing its 2026 subsoil use agreement with the Kazakh government from 32,777 tonnes to 29,697 tonnes—a 10% cut. Kazatomprom also noted that it is highly likely to exercise its "down-flex" option within the allowable 20% deviation under its newly lowered 2026 production framework. In practical terms, the company now expects to produce only 62 million pounds of uranium in 2026—five million pounds less than the reduced 2025 level.

Only a few years ago, Kazatomprom was projecting that it would produce 80 million pounds of uranium in 2025, and that, by utilizing 100% of its 32,777-tonne subsoil-use rights from the Kazakh government, 2026 production would rise to roughly 85 million pounds. Today, however, it appears that 2026 output will reach only 62 million pounds—a massive reduction from the 85-million-pound figure once presented as achievable.

In its first-half 2025 financial release, the company attributed most of the 10% production downgrade to "production adjustments" at Budenovskoye. Kazatomprom also noted that financing had finally been secured for an 800,000-tonne sulfuric acid plant—critical for the viability of the project—and that construction was under way on additional Budenovskoye

processing facilities expected to add 6,000 tonnes of annual capacity. No timeline was provided for completion; the press release offered only that "construction … is progressing in accordance with its schedule."

In earlier letters, we discussed the problems at Budenovskoye and the central role the project was expected to play in closing the emerging structural gap between global uranium supply and demand. It now appears that much of the project's originally envisioned 15-million-pound annual output may never materialize.

Uranium supply problems are not confined to the eastern hemisphere. Cameco—the largest uranium producer in the West—has also been forced to trim its 2025 production guidance for the McArthur River mine, one of the world's premier uranium assets. The company had originally projected that McArthur River would produce 18 million pounds of uranium in 2025. However, due to development delays and slower-than-expected progress on ground-freezing operations, Cameco has lowered its forecast to between 14 and 15 million pounds.

Cameco has not indicated whether these issues will affect its 2026 production, and it is a development we will continue to watch closely. But the implications are clear: production setbacks at McArthur River add yet another data point to the growing evidence that supply constraints will only widen the uranium market's emerging structural deficit in the years ahead.

Finally, we believe it is imperative to address one potentially significant risk to future supply. One of the largest sources of new uranium expected to enter the market between now and 2030 is NexGen's Arrow/Rook I project in Saskatchewan. The mine has advanced almost completely through Canada's multilayered permitting process. Provincial approval was granted in November 2023. The critical federal Environmental Impact Statement was accepted as final in January 2025.

Only one approval now remains before construction can begin: authorization from the Canadian Nuclear Safety Commission (CNSC). The CNSC has scheduled two public hearings on the project—one this November and another in February 2026. Upon the successful conclusion of these meetings, the Commission will issue its decision.

If the CNSC grants approval—and we see no immediate reason to expect difficulties—the project can move directly into construction. And it is at that point, we believe, that the real challenges may begin.

The company has stated that it will take just under four years from the start of construction to first production. If the CNSC grants its approval for the Rook project at its February 9th meeting next year, that timeline would imply initial uranium output in early 2030.

We have been closely involved in numerous large-scale mine construction projects over the past thirty-five years, and based on that experience, we believe there is a meaningful risk that Rook's schedule will slip. This is an enormous undertaking—one that requires not only the development of the mine itself but also the construction of a full ore- and uranium-processing complex.

NexGen is confident it can meet its aggressive timetable. But given the realities of northern Saskatchewan—its climate, its infrastructure limitations, its logistical constraints—we believe holding to that schedule will be extremely difficult. We want to emphasize that any

delays should not be interpreted as a reflection on the quality of the project or its management. They would simply be the natural consequence of the complexities inherent in building a mine of this scale.

The last major uranium mine built in Canada was Cameco's Cigar Lake. Construction began in 2005, with first production originally slated for 2007. Instead, the project quickly encountered severe development issues—most notably significant water incursion—that triggered years of delays. Cigar Lake eventually produced its first uranium eight years behind schedule.

The geology at Rook is markedly different from Cigar Lake, and similar flooding problems are not expected. Even so, large-scale mine developments always present unforeseen challenges. Delays are not the exception but the rule, and it would be highly unusual for a project of Rook's scale to proceed without encountering setbacks.

Rook is projected to begin production at 21 million pounds per year, ramping to as much as 30 million pounds—a contribution unmatched by any other new uranium project over the next decade. Any delay in achieving those volumes will further widen the global uranium market's structural deficit, particularly as demand accelerates into the 2030s.

According to the WNA's newly released *World Nuclear Fuel Report*, uranium demand is set to surge between now and 2040—a conclusion we strongly share, given nuclear power's formidable advantage in producing low-cost, carbon-free electricity. What remains far less clear is where the necessary uranium supply will come from.

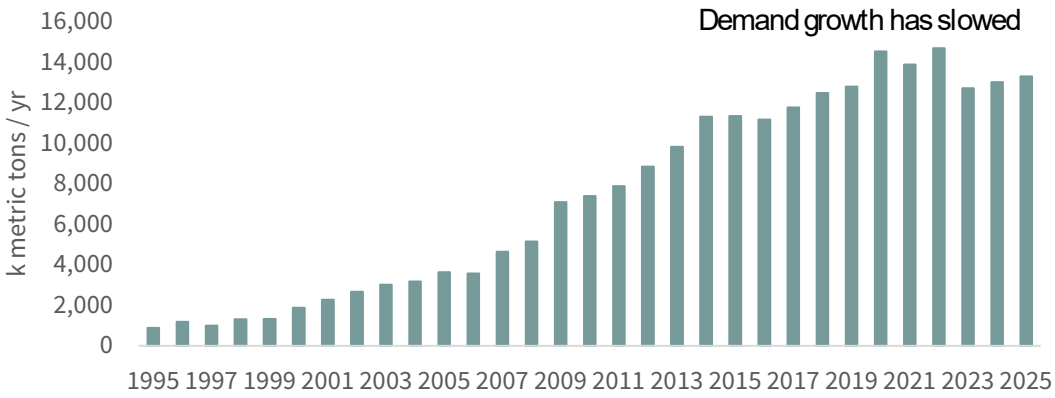
Problems are already emerging at several of the world's largest prospective sources of new production, and we believe the structural deficit in global uranium markets is poised to widen sharply in the near term as these supply issues continue to accumulate. We have highlighted two major setbacks that have surfaced recently, and a third—the Rook project—sits plainly on the horizon.

Over the past two years, the positive narrative around uranium has been driven almost entirely by demand. We believe that is about to change. Supply challenges may soon become the dominant force pushing uranium prices materially higher in the short term.

Murky Waters in Global Copper

Estimating China's copper demand in the post-COVID period has been unusually difficult, made harder by the unwinding of the country's long-standing residential housing bubble. Still, as we move into the second half of this decade, the picture is finally becoming clearer: China's copper demand is slowing. After several revisions over the past twelve months, the World Bureau of Metal Statistics has meaningfully reduced its estimates, especially for 2023 and 2024. In earlier letters, we pointed out that recently released copper consumption data suggested China was overconsuming copper for the first time since the mid-1990s. Looking back, that now appears to have been an accurate call.

FIGURE 16 Chinese Copper Consumption



Source: WBMS,

In our second-quarter 2024 letter, we laid out the situation plainly: "For years now we've been singing a familiar refrain: China's copper consumption has stayed closely in line with our projections, and bearish calls for a downturn in Chinese demand have consistently missed the mark. However, a twist in the story may be upon us. Our models now suggest that China is indeed overconsuming copper." We also added a sharper note in that same letter: "Let us not mince words—China's overconsumption of copper relative to our models introduces a potential bearish factor into global copper markets that warrants scrutiny."

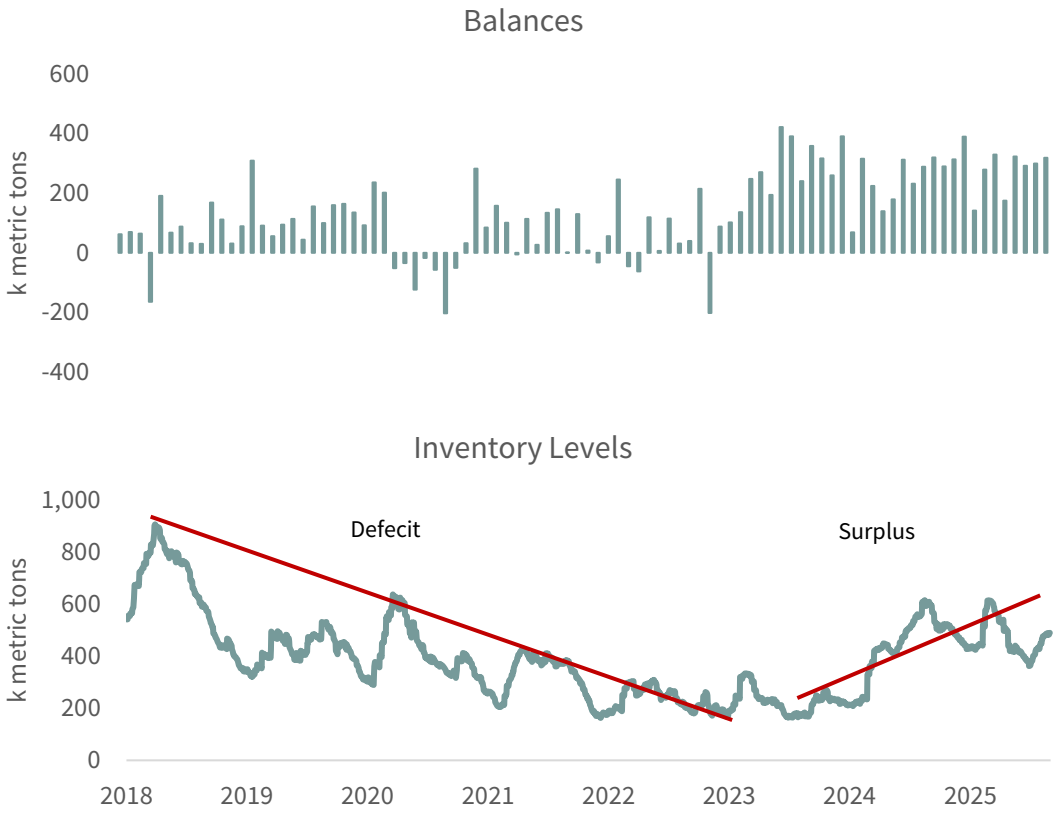
In the letter that followed, we returned to this theme. "In our last letter," we wrote, "we discussed how China—the dominant force in copper demand for the past quarter-century—has now entered an era of overconsumption. As we look ahead to 2025, it is clear that China has moved from under-consuming copper to over-consuming it—a shift with important implications."

In retrospect, our observations about China's copper consumption appear to have been correct. Beginning early this summer, the WBMS started to make substantial cuts to its estimates of China's demand. The first move was sweeping: the bureau reduced its 2023 and 2024 consumption figures by 1.8 million tonnes each—roughly 10%. Later in the summer, more downward revisions followed. Chinese demand for 2023 and 2024 was cut by an additional 2 million and 2.3 million tonnes, respectively. These large adjustments have shifted our copper market models from showing a structural deficit to showing a structural surplus.

The scale of these revisions also clarifies a contradiction that had been troubling the data: why easily mobilized copper stocks—those held on the COMEX, LME, and Shanghai Metals Exchange—were rising when our models suggested they should have been falling.

Using the newly updated Chinese demand figures, it becomes clear how the market has shifted into surplus—a shift now plainly confirmed by rising exchange inventories.

FIGURE 17 Global Copper Balance and Inventory Level



Source: WBMS.

For the first eight months of 2025, the global copper market breaks down as follows: on the demand side, OECD consumption is up 100 tonnes, roughly 2%. Non-OECD demand ex-China is down 155 tonnes, or 5%, with the decline centered in South Korea, Japan, and Taiwan. China's demand rose by 160 tonnes, or 2%. Altogether, global copper demand appears to have increased by about 100 tonnes.

On the supply side, mine production grew by roughly 350 tonnes. Scrap recovery added another 150 tonnes over the same period. Taken together, the numbers now point to a copper market that is once again comfortably in surplus—by roughly 350 tonnes for the year.

In upcoming letters, we will return to our models of Chinese copper consumption. The sharp cuts to China's demand estimates now bring the country's copper use back in line with where it should be. Still, given that China accounts for nearly 55% of global copper demand, understanding its future path remains critical. China's copper consumption now sits below its 2021 level, and this pullback has pushed the global market back into surplus—a surplus confirmed by the recent behavior of exchange inventories.

We will also revisit copper mine supply, including the most recent shutdown of underground block-caving operations at Freeport's Grasberg mine following a tragic accident, as well as the flooding at Ivanhoe Mining's Kakula mine. In our next letter, we will discuss how these disruptions are likely to affect global copper supply in 2026.

Over the past several years, the copper mining industry has enjoyed remarkable success in finding new, extremely large, high-grade deposits, particularly in the Western Foreland of

the Democratic Republic of the Congo and on the Argentinian side of the high Andes. The consensus view holds that copper demand will outstrip mine supply over the next decade as production falls short, but the data to this point has not confirmed that trend.

Take, for instance, the loss of Cobre Panamá's 330,000 tonnes of production at the end of 2023. Even with that entire volume removed, global mine supply has continued to grow. In 2021, copper mine output stood at roughly 21.3 million tonnes; our estimate for 2025 is 23.3 million tonnes—a 10% increase over the 2021 level. By contrast, because of the sharp slowdown in Chinese growth, copper demand since 2021 has been essentially flat.

Over the last three years, followers of the copper market turned almost wildly bullish as demand-growth assumptions soared—fueled by expectations of massive investment in renewables and chronically disappointing mine supply. We have remained skeptical of both ideas, and the data now coming in appears to support our more neutral stance toward copper.