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WHAT IS THE COST OF BEING EARLY?

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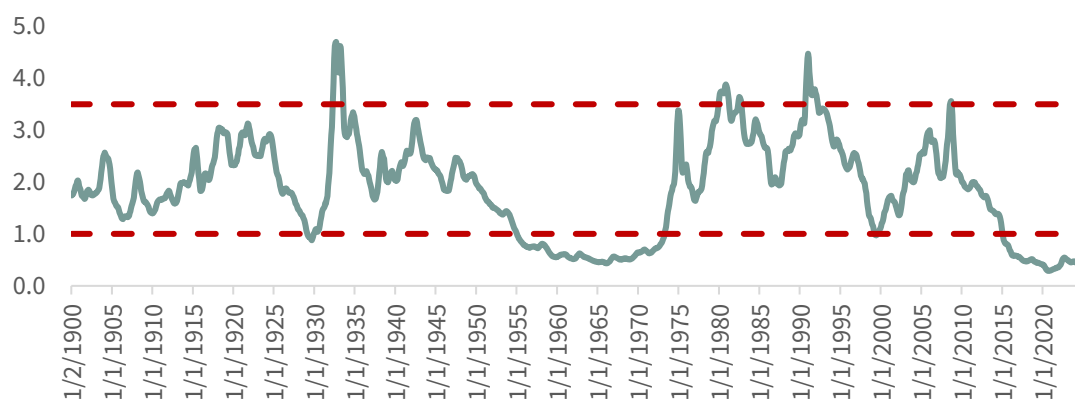
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We first unveiled this chart (shown below) in our 1Q2019 letter and have since revisited it many times. It's a chart of unassuming elegance, plotting nothing more than the ratio of a commodity total return index against the Dow Jones Industrial Average. The origins of this chart trace back to Jeffrey Gundlach of DoubleLine Capital, who in turn may have drawn inspiration from a similar chart published by Tony Boeckh, the astute founder of BCA Research and Alpine Macro.

Mr. Gundlach's chart plotted the relationship between commodities and stocks from the inception of the GSCI Commodity Index in 1970. But our curiosity took us further back. We wanted to see how this relationship fared in earlier periods, so we painstakingly constructed our own commodity total return index dating back to 1900, using the same methodology as the GSCI. Our findings were revelatory: commodities and common equities do indeed

move in long cycles, often as mirror images of one another. This cyclical nature leads to distinct periods when commodities are glaringly undervalued relative to equities—moments when commodities present tremendous investment opportunity -- and others when they were expensive and best avoided.

FIGURE 1 Commodities - Dow Jones Ratio



Source: Bloomberg, G&R Models.

Over the past 125 years, commodities have reached these points of extreme undervaluation relative to equities on four notable occasions: 1929, 1969, 1999, and most recently, 2020. After each of the first three lows, commodities and natural resource equities went on to dramatically outperform the broader market, and we suspect history is poised to repeat itself.

A closer examination of these periods reveals several consistent patterns. First, commodities tend to perform dismally in the lead-up to these inflection points, often plummeting by 50% or more. Second, these periods of commodity despair are invariably accompanied by a stock market mania—whether it was the broad market euphoria of the 1920s, the Nifty Fifty craze of the late 1960s and early 1970s, the dot-com bubble of the 1990s, or the dominance of Big Tech in the 2010s. Dual forces -- falling commodity prices on one side, and exuberant equity markets on the other -- drive the commodity-to-equity ratio to extremes.

Third, each instance of extreme commodity undervaluation was preceded by a period of easy money. Consider the 1920s, when the U.S. experimented with its first round of quantitative easing under Benjamin Strong. Or the 1960s, with President Johnson’s “Guns and Butter” policies. Then there was the Greenspan era in the 1990s, marked by ever-looser monetary policy despite robust economic conditions. Following the Global Financial Crisis, central banks around the world printed money with a reckless abandon never seen before, expanding their balance sheets to unprecedented levels. This excess liquidity only served to push commodity prices lower and equity prices higher, driving our ratio from cheap to extreme.

Fourth, as commodities fell out of favor and equities soared, capital was diverted away from new mining and energy projects, ultimately impacting supply just as demand remained strong. Eventually, this supply-demand imbalance pushed commodity markets from surplus to deficit, sparking a period of strong absolute and relative returns for commodities and natural resource equities.

Finally, each of these inflection points coincided with a shift in the global monetary system. In 1930, the world bid farewell to the Classical gold standard after years of massive post-war instability. In 1968, President Johnson's legislation effectively severed the U.S. dollar's ties to gold, setting the stage for the Nixon "gold shock" and the eventual demise of Bretton Woods in 1971. And in 1999, the fallout from the Asian currency crisis led to a wave of emerging market currencies being pegged to the U.S. dollar at artificially low levels--- a move that Russell Napier has called the "No Name Revolution," with consequences as profound as the end of the Gold Standard or Bretton Woods.

Today, commodities are as undervalued relative to common equities as they have ever been. The 2010s saw a decade of commodity weakness, while equities, since the Global Financial Crisis, have entered an almost perpetual bubble. Central banks have printed more money in recent years than at any time in human history. Investor capital has fled the commodity sector, and corporate spending in the natural resource sector remains at near record lows. Meanwhile, the U.S. dollar's dominance in international trade is being challenged, with countries rushing into gold as a potential hedge against its reserve currency status.

All signs point to the early stages of a prolonged commodity bull market, likely stretching into the 2030s.

Yet, the future trajectory of this bull market remains uncertain. The sharp rebounds experienced in 1929 and 1999 now seem unlikely. In contrast, it now seems we are entering a protracted period of extreme undervaluation like the 1950s and 1960s. So far, the current cycle seems to be echoing the latter, with the commodity-to-Dow ratio remaining below 0.5 nearly a decade after first breaking 1:1 in 2015.

Which brings up the inevitable question: should investors allocate capital to natural resources markets if we are about to repeat the experience of the 1950's and 1960's— a period where commodities remained radically undervalued for over 15 years? The answer to this question is simple and profound: when commodities and natural resource equities are deeply undervalued such as they were in the mid- 1950's, the cost of buying into these markets is surprisingly low—if it exists at all. Indeed, the greater danger to long-term performance lies in showing up late to the commodity bull market party. Investor concern, although easy to understand, overlooks what actually happened during that 15-year period--as you shall see.

Our analysis, based on data from Professor Kenneth French, led us to create a natural resource equity index* consisting of an equally weighted portfolio composed of energy, gold, base metal, and agricultural equities, rebalanced annually. We scrutinized how this portfolio performed at each market bottom and assessed the impact of early entry on overall returns. The findings are illuminating.

In early 1929, just as the broad market was reaching its zenith and natural resource equities were plumbing their depths, the commodity-to-Dow ratio breached 1:1. An investor who had the foresight to buy the natural resource equity basket at that moment would have doubled their money between April 1929 and April 1937. Meanwhile, those invested in the Dow or S&P 500 would have suffered losses of 45% and 35%, respectively. Natural resource equities delivered an impressive 9% annual return during this period, far outpacing the broad market's dismal performance. Importantly, being early was not an issue —the ratio broke one in April 1929, bottomed only a few months later and quickly started rallying. Despite the inherent economic sensitivity of natural resource stocks, their maximum drawdown

THE ANSWER TO THIS QUESTION IS SIMPLE AND PROFOUND: WHEN COMMODITIES AND NATURAL RESOURCE EQUITIES ARE DEEPLY UNDERVALUED SUCH AS THEY WERE IN THE MID- 1950'S, THE COST OF BUYING INTO THESE MARKETS IS SURPRISINGLY LOW—IF IT EXISTS AT ALL. INDEED, THE GREATER DANGER TO LONG-TERM PERFORMANCE LIES IN SHOWING UP LATE TO THE COMMODITY BULL MARKET PARTY.

was 68% between 1929 and 1937, a far cry from the near 90% drawdown experienced by the Dow and S&P 500.

The story repeated itself in 1999. Once again, being early proved inconsequential: the commodity-to-Dow ratio first broke 1:1 in April before bottoming months later and rallying. Natural resource equities surged 344% between April 1999 and May 2011, while the Dow and S&P 500 posted gains of only 57% and 28%, respectively. On an annualized basis, natural resource equities rose by 13%, outperforming the Dow and S&P 500 by a staggering 9% and 11% per year respectively.

The 1954 to 1980 period was more complicated. In December 1954, the commodity-to-Dow ratio breached the 1:1 threshold, a moment that might have signaled a bottom. Yet, rather than rallying as one might expect, the ratio meandered lower, descending over the next eleven years to a low of 0.4 by February 1966. Even then, the awaited rally did not materialize with any vigor, instead lingering in a range until finally breaking higher in 1970. By 1981, however, the ratio had soared to a remarkable 4:1—one of the loftiest readings on record

While the commodity-to-Dow ratio continued its descent during the subsequent decade, commodity prices themselves did not stand still. Between December 1954 and January 1970, commodities advanced by 25%—a modest gain, to be sure, yet upward progress nonetheless. Natural resource equities, meanwhile, benefitted from investor neglect, and their depressed valuations offered investors tremendous opportunity. From December 1954 to January 1970 the basket of natural resource stocks delivered a total return of 320% during this period, outpacing both the Dow and the S&P 500, which rose by 135% and 294%, respectively. On an annualized basis, the resource stock basket returned 10.0%, comfortably ahead of the Dow's 5.8% and the S&P 500's 9.5%.

BEING EARLY, AS IT TURNS OUT, WAS NO DISADVANTAGE. YES, THE RIDE WAS BUMPY—THE MAXIMUM DRAWDOWN FOR OUR COMMODITY STOCK BASKET WAS A DAUNTING 36% IN LATE 1957, COMPARED WITH 22% FOR THE DOW AND S&P 500 IN 1962. YET, FOR THOSE WITH THE FORTITUDE TO WEATHER THE VOLATILITY, THE REWARDS WERE SUBSTANTIAL.

Being early, as it turns out, was no disadvantage. Yes, the ride was bumpy—the maximum drawdown for our commodity stock basket was a daunting 36% in late 1957, compared with 22% for the Dow and S&P 500 in 1962. Yet, for those with the fortitude to weather the volatility, the rewards were substantial.

From 1970 to 1980, as commodities surged, natural resource equities truly came into their own, quintupling in value with a 16% annual return. By contrast, the Dow and S&P 500, with gains of 93% and 122%, respectively, advanced at an annual clip of 6.4% and 7.8%—both trailing resource equities by significant amounts.

Viewed from the broader perspective of 1954 to 1980, the investor who stepped in when the commodity-to-Dow ratio first broke one in 1954 would have achieved a staggering 2,000% return, or 12.5% annually. The Dow, for all its “blue chip” luster, advanced by a comparatively modest 385%, or 6.3% annually, while the S&P 500 rallied 828%, or 9.0% annually. In relative terms, the natural resource investor outperformed the Dow by 6.2% and the S&P by 3.5% annually.

Had an investor possessed the foresight to wait until 1970, when commodities were poised for a spectacular surge, they would have enjoyed a 16% annual return for the ensuing decade, besting the indices by 9% per year. However, even for those who were “extremely early” and bought natural resource stocks in 1954, the result was still impressive—a 12.5% annual return by 1980, surpassing the indices by nearly 5% annually. Notably, during the 15-year

lead-up to the commodity turn, they would have outperformed both the Dow and the S&P 500. The cost of being early, as it turns out, was not a cost at all.

FIGURE 2 Natural Resource Equity Performance By Entry Point

	Nat Res Equities	Dow Jones	S&P 500
1954-1980	12.5%	6.3%	9.0%
1970-1980	16.1%	6.4%	7.8%

Source: CRSP via Professor French Data Library, G&R Models, Bloomberg.

Ironically, we believe the biggest risk is in being late. Waiting until 1970 would have meant missing half of the rally. Had an investor chosen the Dow from 1954 until 1970 and then presciently switched to commodity stocks, his total cumulative return would have been half of what it would have been if he had simply bought commodity stocks early. Had he instead chosen the S&P 500 before changing course adeptly in 1970, his return would still have trailed. Factoring in the realized capital gains impact of rotating from the S&P to resource stocks, of course, makes our case much stronger.

Fast forward to our current cycle, where the commodity-to-Dow ratio first broke 1:1 in 2015. Since then, the ratio has reached an all-time low: hitting 0.3 in September 2020. Once again, the feared cost of being early has proven to be minimal. Since 2015, the natural resource equity portfolio—equally weighted between energy, base metals, precious metals, and agriculture-- has returned 175%, or 11.3% annually—keeping pace with the Dow and only slightly trailing the S&P 500.

Since the ratio's bottom in 2020, natural resource portfolios have performed even better, advancing 140%, or 23% annually, compared with 95% and 126% for the Dow and S&P, respectively.

We believe today's present cycle mirrors that of 1954-1980 in many respects. Commodities first became radically undervalued in 1954 when the ratio broke the 1:1 mark, only to take years to bottom in 1966 and several more before beginning their outperformance in 1970. Similarly, in this cycle, the ratio first broke 1:1 in 2015 and bottomed six years later at 0.3 in 2020. Now, nearly four years past that bottom—akin to where we were in 1970—we believe commodities are poised to begin radically outperforming once more.

In both periods, the fear of being early was misplaced—there was no cost associated with being early. And, as we just discussed, we believe the present cycle is shaping up to be no different.

And so, we return to the perennial question: what is the cost of being early? If history is any guide, the cost is, at worst, negligible, and at best, a gateway to outsized returns. The real

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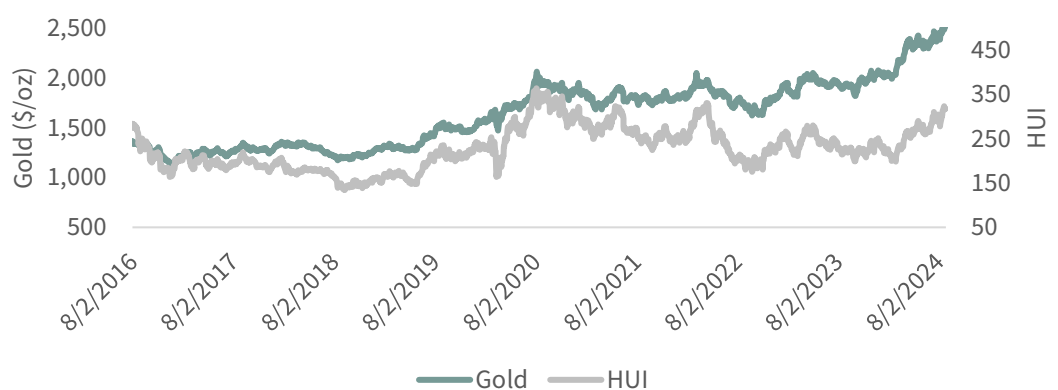
peril lies in hesitating--waiting for the perfect moment that may never come.

Gold Stocks Have Never Been Cheaper

As we write, gold has surged past the \$2,500 mark for the first time in history, an event that would seem to herald a golden age for gold stocks. Yet paradoxically, these stocks have seldom been cheaper. What underlies this dissonance, and what might it portend for the future?

Before delving into these questions, it's instructive to reflect on the historical backdrop. The last great bull market in gold spanned from 1999 to 2011, during which the price of gold soared from \$252 to \$1,900 per ounce, an eightfold increase. After a sharp correction between 2011 and 2015, gold resumed its upward trajectory, now trading 30% above its 2011 peak. Gold equities, however, have failed to follow suit. The NYSE Arca Gold Bugs Index (HUI), a benchmark for gold stocks, languishes at 312, more than 50% below its September 2011 high. Even more striking, the HUI today is only 10% above its August 2016 level—when gold was a mere \$1,300 per ounce. Meanwhile, the HUI's earnings per share are expected to quadruple this year compared to 2016.

FIGURE 3 Gold Price vs. HUI GoldBugs Index



Source: Bloomberg, G&R Models.

This disconnect between gold and gold equities is largely explained by interest rates and the behavior of central banks. Since 2020, real U.S. 10-year interest rates have climbed from -0.40% to 2.1%. Western investors, habituated to offloading gold in response to rising real rates, have acted predictably. From 2020 to 2024, gold ETFs shed 31 million ounces, or 25% of their holdings, as investors sold both bullion and equities. The largest gold stock ETF, the GDX, experienced consistent outflows amounting to nearly 20% of its assets. This is reminiscent of past cycles; between 2012 and 2015, as real rates rose from -0.20% to 0.80%, gold ETFs liquidated 36 million ounces.

Yet this rate hike cycle has a critical difference: for the first time in decades, central banks have emerged as significant buyers of gold. Between 2020 and 2024, central banks accumulated an estimated 106 million ounces of gold, more than offsetting the liquidation by Western investors. Consequently, despite the sharp rise in real interest rates, gold has nearly

AS CONTRARIAN VALUE INVESTORS, WE SEE EXTRAORDINARY OPPORTUNITY IN THIS DISPARITY AND HAVE BEEN INCREASING OUR POSITIONS IN GOLD EQUITIES. A COMMON QUESTION WE ENCOUNTER IS WHETHER SOME FUNDAMENTAL CHANGE HAS OCCURRED WITHIN THE GOLD MINING INDUSTRY TO JUSTIFY THIS EXTREME UNDERVALUATION. SPECIFICALLY, THERE'S CONCERN THAT RISING COSTS HAVE ERODED THE PROFIT MARGINS THAT SHOULD HAVE EXPANDED WITH THE RISING GOLD PRICE.

doubled. Unfortunately for gold mining executives, central banks are interested in gold bars, not gold shares. With no natural buyer to counteract Western selling, gold equities have been left in the dust, now trading at historically low valuations.

As contrarian value investors, we see extraordinary opportunity in this disparity and have been increasing our positions in gold equities. A common question we encounter is whether some fundamental change has occurred within the gold mining industry to justify this extreme undervaluation. Specifically, there's concern that rising costs have eroded the profit margins that should have expanded with the rising gold price. While comparing the HUI with gold is a useful exercise, it doesn't capture the full picture of the gold mining sector's underlying health.

To gain clarity, we've constructed an index* of six major gold producers: Newmont, Barrick, Harmony, Goldfields, and Agnico Eagle. Together, these companies produce 17 million ounces of gold and hold 343 million ounces of proven reserves, giving them a combined reserve life of 20 years. With a collective enterprise value of \$130 billion, these companies represent nearly 40% of the entire industry. Crucially, they all have financial records dating back to at least 2000, allowing us to compare current undervaluation with past extremes.

Consider the bear market bottom of 1999. Following two decades of inflation and the end of the Bretton Woods system, gold peaked at \$850 per ounce in January 1980, only to lose 79% of its value over the next 19 years, bottoming at \$252 in August 1999. The Barron's Gold Stock Index (the precursor to the HUI) mirrored this decline, falling 84% before also bottoming in 1999.

In 1999, our six companies produced 12 million ounces of gold at an average cost of \$200 per ounce. With gold averaging \$279 for the year, these companies generated a combined adjusted EBITDA of just \$1 billion. Their combined net asset value (NAV), calculated using a discounted cash flow (DCF) model with a 10% discount rate and \$292 gold price, was \$9 billion, compared to an enterprise value of \$15 billion, implying a multiple of 1.8x.

At market lows, it's also helpful to compute a company's "real option value" alongside its DCF. When commodity prices are depressed, a company's profitability—and hence its DCF value—may appear negligible or negative. However, if investors anticipate a rise in the commodity's price, the stock can be viewed as a series of call options. The underlying asset is the gold price, the strike price is the cash cost of production, and the quantity is the expected annual production. Using Black-Scholes, we can estimate this option value and discount it to the present. In 1999, the combined real option value of our six companies was nearly \$18 billion, against an enterprise value of \$15 billion, suggesting they traded at 0.80x their real option value.

Another useful measure is the enterprise value per ounce of proven reserve, compared to the gold price. In 1999, the companies had 240 million ounces of proven reserves and a combined enterprise value of \$15 billion, or \$61 per ounce of proven reserve. This meant that investors could buy gold in the ground for just 23% of the spot price.

Fast forward to 2011, when gold had soared nearly eightfold to \$1,900 per ounce. The HUI index rose sixteen-fold from 38 to nearly 600, while the market capitalization of the industry surged from \$5 billion to \$253 billion. At the market's peak in 2011, gold miners accounted for nearly 2% of the S&P 500, up from just 0.4% in 2002.

The six companies saw their enterprise value rise eightfold from \$15 billion to \$115 billion. Was this justified? Their combined revenues increased eightfold—consistent with both the gold price and their enterprise value. Despite rising costs, EBITDA grew nearly sevenfold from \$2 billion to \$13 billion. Their NAV, as measured by DCF using a 10% discount rate and \$1,600 gold price (the 2011 average) increased sixteen-fold from \$10 billion to \$160 billion, far outpacing the rise in their enterprise value. The companies' real option value also surged. From \$18 billion in 1999, their option value grew ninefold to \$200 billion by 2011.

The years following 2011 were brutal for gold stocks. By late 2015, gold had dropped nearly 50% to \$1,051 per ounce, and the HUI had plummeted 85%, from 635 to 104. The market capitalization of gold miners fell from \$253 billion to just \$54 billion, shrinking from 2% to 0.3% of the S&P 500.

Our index's equity value declined by 73% during this period, as production fell by nearly 20%, revenues by 40%, and costs rose by 22%. The companies' DCF valuation dropped by 65%, using a 10% discount rate and \$1,160 gold price while their real option value halved. By 2015, the companies' enterprise value had dropped to \$40 billion—equivalent to 70% of their DCF value and just 0.40x their real option value. With 275 million ounces of proven reserves, the enterprise value per ounce was \$150, or 12% of the spot price.

The bear market that ended in 2015 was a time of extreme undervaluation, providing an excellent opportunity for contrarian investors. Indeed, over the next five years, gold stocks surged by 218%, far outpacing the S&P 500, which gained 75%, and even the tech-heavy Nasdaq, which rose by 146%.

Today, we find ourselves at a similar juncture. Gold has rallied from its 2015 low of \$1,051 to an all-time high of \$2,500, while the HUI has risen from 100 to 312. Yet despite this, the market capitalization of gold miners remains at \$220 billion, which is the same as it was in 2011 despite the fact that gold is 35% higher and the S&P 500's market capitalization is four times greater. Gold stocks now make up just 0.50% of the S&P 500, a figure reminiscent of the market bottom in 2015 rather than speculative tops.

Our index of six companies has seen their enterprise value grow by 150% since 2015, while their production has increased by only 10%, revenues have doubled, and EBITDA has grown sixfold. Their NAV has tripled, using a 10% discount rate and \$2,200 gold price and their real option value has risen by a similar magnitude. Despite this, they currently trade at just 0.60x their DCF value and 0.38x their real option value—levels not seen since 1999.

At the most extreme reading earlier this year, these companies were valued at just \$292 per ounce of proven reserve, or 12% of the spot price—again, the lowest on record.

By April 2024, gold stocks were as cheap as they have ever been. The only comparable period is the market bottom in 2015. However, unlike 2015, gold is now at an all-time high. Back then, a value investor had to anticipate a rise in the gold price to justify an investment in gold equities. That is not the case today. Moreover, in 2015, the industry's profit margins were slim—just 12%. Today, they are nearly 40%. From an operational standpoint, the margin of safety is much greater now than it was in the past.

In essence, gold equities today offer an unprecedented combination of low valuation and high potential return. Normally, when a commodity reaches new highs, investor interest is intense and valuations are stretched. Yet in the case of gold stocks, investor interest remains

WHILE RECENT GAINS IN GOLD STOCKS MAY BE ATTRIBUTED TO SHORT-COVERING RATHER THAN RENEWED ENTHUSIASM, THE UNDERLYING VALUE PROPOSITION IS CLEAR. IN AN ENVIRONMENT WHERE GOLD IS HITTING NEW HIGHS, YET GOLD EQUITIES REMAIN DEEPLY UNDERVALUED, ASTUTE INVESTORS SHOULD TAKE NOTE. THE CURRENT OPPORTUNITY IS AS COMPELLING AS ANY WE'VE SEEN IN THE HISTORY OF THE GOLD MARKET.

muted. Even as gold has rallied, investors have continued to withdraw funds from gold equity ETFs, with \$1.5 billion redeemed from the GDX thus far in 2024—a testament to the widespread disinterest in the sector.

While recent gains in gold stocks may be attributed to short-covering rather than renewed enthusiasm, the underlying value proposition is clear. In an environment where gold is hitting new highs, yet gold equities remain deeply undervalued, astute investors should take note. The current opportunity is as compelling as any we've seen in the history of the gold market.

Trump's Three Arrows

“Let us pledge that by 1980, under Project Independence, we shall be able to meet America's energy needs from America's own energy resources.” President Richard Nixon, November 7th, 1973

“We will lower the cost of energy. We will drill, baby, drill. We will do it at levels that nobody's ever seen before.” President Trump, Republican National Convention, July 19th, 2024

President Trump has once again pledged that, if re-elected, he will slash the cost of energy in the USA. At the Republican National Convention, he declared his intention to spark a monumental drilling boom that would flood the market with oil and natural gas, ultimately bringing prices down to a comfortable level for all.

Should Trump win the upcoming election, we can anticipate an uptick in his rhetoric. This rhetoric will undoubtedly send strong negative signals through the investor community—a community that has already adopted a bearish outlook on global oil and gas markets. But here's where it gets intriguing: despite the sincerity and good intentions behind Trump's plans, our analysis suggests that the geological forces at play make this pledge more of a wish than a realistic goal.

President Trump is not the first president to put forward a national goal of significantly increasing US oil and natural gas production. In 1973 President Nixon announced the same goal which was thwarted by geological forces—ironically the same geological forces strongly at work today.

Our research, though controversial and met with skepticism by some commentators, leads us to stand firm in our conclusions. Critics argue that we misunderstand the interchangeability of energy molecules—such as the notion that natural gas, with its perceived surplus, can seamlessly replace oil in various applications. Yet, we remain steadfast in our belief that U.S. shale oil and natural gas have reached their peak and are on the cusp of decline. We ask that you, the reader, proceed with an open mind.

The shale boom that has taken the world by storm since 2010 is spectacular. U.S. shale oil

has accounted for nearly 90% of global non-OPEC oil supply growth. Shale gas turned America from a significant LNG importer into the world's largest exporter. Today the US comprises almost 25% of global LNG production.

However, as impressive as this surge is, our analysis indicates that U.S. shale oil and natural gas have peaked. The narrative is reminiscent of the 1970s when U.S. oil and gas production continued to fall despite skyrocketing prices and an unprecedented drilling frenzy.

Let us rewind to those crisis-filled days of the 1970s. Oil prices had soared, gas lines stretched for miles, and President Richard Nixon delivered his famous “Energy Independence” speech to the American public on November 7, 1973. With visions of “Project Independence,” Nixon aimed to free America from its reliance on imported oil. But unbeknownst to him, geological constraints were at play that would make this goal unattainable for decades.

In 1970, the U.S. produced 11.3 million barrels of oil per day. Despite a tenfold increase in oil prices and a fourfold increase in rig counts by 1981, production had declined by over 1 million barrels per day. It was Hubbert's Peak, that pesky geological principle that rendered further growth impossible. Unbeknownst to President Nixon, the US in 1970 has just produced half of its recoverable conventional oil and natural gas reserves, making both future production growth, and President Nixon's energy independence goal impossible to achieve.

Note the fascinating trajectory of oil prices, rig counts, and U.S. oil production in the graph below. You'll see a story that challenges the conventional wisdom that more drilling always produces more production. Back in the 1970s, U.S. production didn't grow as expected despite one of the most significant drilling booms in history. It's a tale of exuberance and excess, wonderfully chronicled in Mark Singer's *Funny Money*. This book explores the spectacular collapse of Penn Square Bank, which led to the downfall of Continental Illinois—once deemed among the best-managed banks in the nation. Singer captures the essence of the drilling frenzy that gripped the oil and gas community across the U.S. We highly recommend our investors read the book.

But why did U.S. oil production decline even as the rig count soared fourfold? As discussed in a previous essay, “Remembering 1970 and 2000,” the U.S. hit its Hubbert's Peak in 1970. This principle tells us that once a field produces half of its ultimate recoverable conventional reserves, there's little anyone can do—geologist, engineer, or politician—to reverse the trend. Over fifty years, U.S. conventional production has declined to a mere 3.3 million barrels per day, a steep drop of nearly 75% from its 1970 peak.

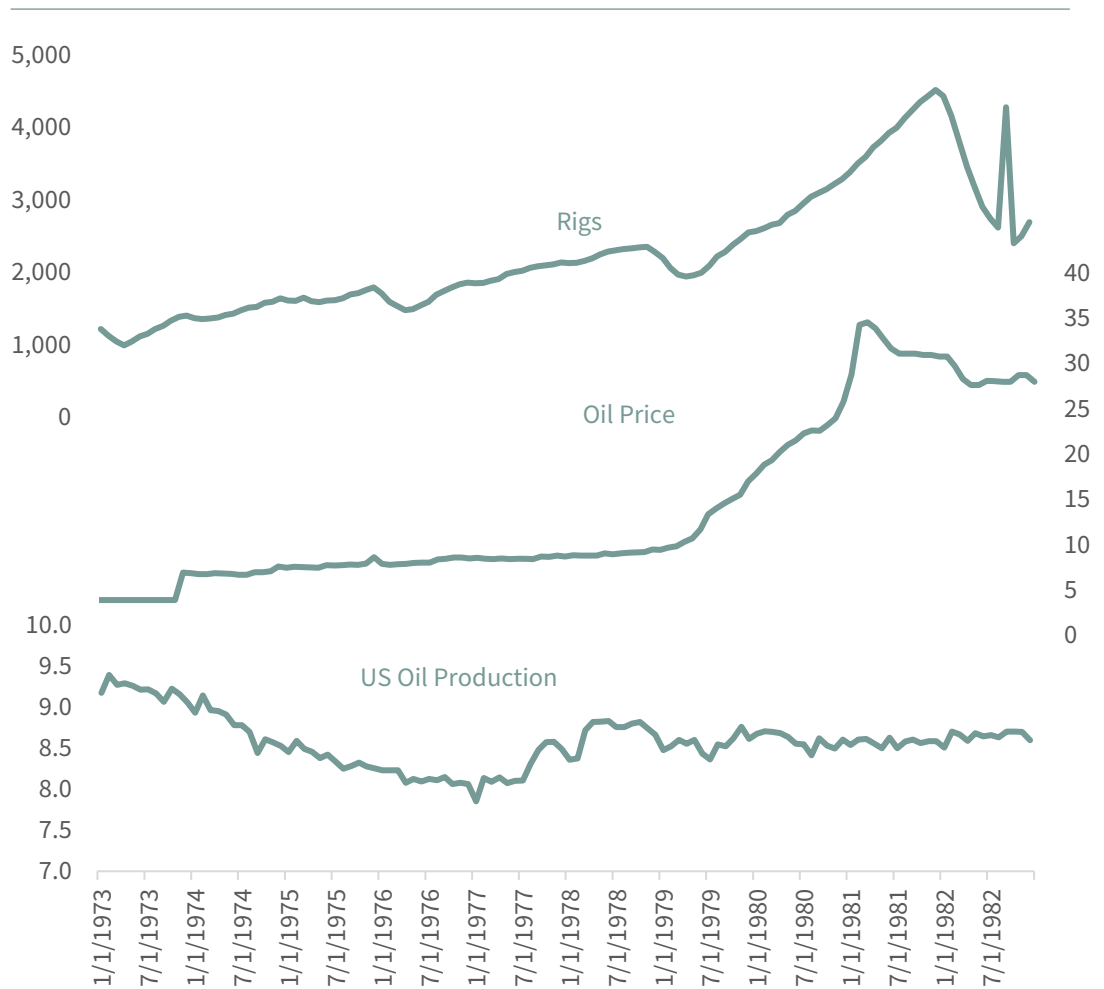
Though earnest in his efforts to achieve energy independence, President Nixon was thwarted by these immutable geological forces. As the 1970s progressed, America's dream of energy independence drifted farther out of reach. By 1979, the demand for imported oil had climbed from 6.4 million barrels per day to 8.3 million, making independence more elusive than ever. For those keeping score, the gap between U.S. production and supply widened, peaking in 2006 at 13.6 million barrels per day, just as the shale revolution gained momentum.

Surging drilling activity also failed to lift natural gas production. Falling natural gas production and unusually cold winters produced shortages, culminating in President Jimmy Carter's famous televised sweater speech, urging Americans to turn down their thermostats in the winter of 1977. U.S. conventional natural gas production also reached its peak in the 1970s,

which is right in line with Hubbert's principles. Like its oil counterpart, conventional natural gas production saw a brief uptick in the 1990s but its relentless decline has been impressive. Today, conventional U.S. natural gas production hovers just above 20 billion cubic feet per day, marking a steep fall of over 65% since its peak in the 1970s.

The U.S. found itself navigating two distinct energy crises in the second half of the 1970s: the natural gas crisis of 1977, spurred by dwindling supply and back-to-back frigid winters,

FIGURE 4 US Rig Count, Oil Price & US Oil Production



Source: Bloomberg, G&R Models.

and the 1978 Iranian Revolution, which toppled the Shah and sent oil prices skyrocketing again.

We revisit the 1970s not out of nostalgia for standing in gas lines and living in ice-cold homes, but as a cautionary tale for what this decade might hold since we find ourselves in a similar situation. The U.S. shale revolution began in the early 2000s and has been remarkable, but unfortunately the shales follow the same geological rules as conventional fields. Our models indicate that all shale plays are leveling off and poised for decline, just as conventional production did in the 1970s.

Even if President Trump could engineer a drilling boom, production may not grow as expected. As history shows, the rocks beneath us have a way of dictating their own terms, regardless of the promises made from the podium.

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2024 Q2 Natural Resource Market Commentary

Investors showed little interest in commodities and natural resource equities in the second quarter. The A.I. frenzy continues to dominate the market, and capital flows into the tech sector remain huge. The investment public can focus on little else.

The Nasdaq 100, with its ties to the so-called “magnificent seven,” surged ahead by 8%, decisively outpacing the S&P 500 which posted a 4% gain. Meanwhile, both commodities and natural resource equities were lackluster. The Goldman Sachs Commodity Index, weighted heavily toward energy, crept up by a modest 0.7% while the Rogers International Commodity Index, with more emphasis on metals and agriculture, increased by 2.1%. Natural resource equities saw declines with the S&P North American Natural Resource Stock Index, heavily reliant on energy, dropping by 1.6% and the S&P Global Natural Resource Stock Index, with a greater focus on metals and agriculture, slipping by 2.0%.

Amidst this general malaise, certain commodities exhibited notable strength during the quarter. Copper witnessed a significant short squeeze, soaring to a new all-time high in May of \$5.20 per pound. Henry Hub natural gas hit a low of \$1.61 per mcf as the mild winter withdrawal season ended. However, after bottoming out at \$1.48 per mcf in late March, it staged a remarkable comeback, climbing nearly 50% and emerging as the best-performing commodity of the quarter.

Copper

The US COMEX copper futures market experienced a severe short squeeze in the second quarter. The short squeeze pushed copper prices to \$5.20—a new all-time high. Driven by widely shared beliefs that Chinese property woes would severely impact China’s copper consumption, hedge funds had established significant short positions on the COMEX exchange. With inventory at historically low levels, the stage was set for a significant squeeze. The squeeze was centered here in New York. The COMEX futures price at its peak traded at an unprecedented 55-cent premium to copper prices in London. Previous letters have alerted our readers to the possibility of a short squeeze in copper markets. In our 2Q23 essay, we warned that “given the low-exchange inventories and the bullish supply/demand trends, we believe speculators will soon panic much as they did back at the end of 2005 into 2006 when low inventories combined with massive short covering spiked copper prices higher by almost 200% in just six months.”

In May, Sprott launched its Physical Copper Trust, a closed-end investment vehicle akin to its Physical Uranium Trust, designed to purchase and store the metal. Following the success of the uranium trust, short sellers feared the new Copper Trust might similarly introduce a significant new source of demand, prompting a rush to cover short positions.

The short squeeze in copper markets was short-lived. Copper prices began the quarter at \$4.00—the developing squeeze pushed it to \$5.20 and by quarter end the copper price stood only 35 cents above where it started.

Over the past year, our perspective on copper has become more conflicted. Many investors have adopted an extremely bullish stance. Strong anticipated demand and concerns over mine supply have become the consensus view. As contrarians, we have frequently cautioned against the dangers of herd mentality when most investors converge on a single outlook.

For instance, there is a widespread belief that no growth in copper supply is feasible between now and the end of the decade. However, copper mine supply is now unexpectedly exhibiting strong growth—a development largely ignored by analysts. After six consecutive years of drawing down, copper inventories are now also beginning to rise. While we remain bullish on copper in the short term, as global demand remains extremely strong, we are becoming increasingly cautious about the longer term. Please refer to the copper section of this letter, where we discuss the specifics of both supply and demand.

Natural Gas

Natural gas prices, both in North America and abroad, staged a notable comeback after grappling with severe weather-induced weakness in the first quarter. In the U.S., gas bottomed at the end of April at \$1.64 per mcf, prompted by end-of-season inventories that stood 40% above the ten-year averages. When compared to oil, natural gas flirted with its historic lows. On April 26th, with gas at \$1.61 per mcf and West Texas Intermediate crude at \$83.65 per barrel, the oil-to-gas ratio reached an astonishing 52x, illustrating that traders valued the BTUs contained in an mcf of gas at nearly a 90% discount relative to the BTUs in a barrel of oil. Such an undervaluation was only matched at the end of the comparably mild winter of 2011-2012. As we discussed in our last letter, today's circumstances are far different from those of 2012. Please consult the natural gas section of this letter where we discuss the increasing number of bullish indicators appearing in the North American natural gas markets. As we navigate through the rest of 2024, our optimism for natural gas prices remains as robust as ever.

Oil

After a significant rebound in the first quarter, oil was volatile in the second quarter. The quarter began with oil at \$83. It rallied to \$87, pulled back to \$73, and then closed at \$82 per barrel – near where it started. Despite the volatility, our bullish outlook remains undeterred. We encourage you to read closely the oil section of this letter where we explore the array of bullish indicators that have come to light. Notably, the U.S. shale oil supply, which has accounted for nearly 90% of the growth in non-OPEC oil supply over the past fifteen years, is beginning to decline—a critical development that has gone largely unnoticed by most analysts. This shift in U.S. shale dynamics could have profound implications for global oil markets and further bolster our optimistic stance on oil as we move forward.

Coal

“And yet, despite all the solar panels, all the windmills, the electric vehicles, and the government incentive to go green, the world has never used as much coal as it's burning this year.”

Coal prices were mixed on a global basis. In the United States, the situation was no different. Powder River Basin thermal coal prices dipped by 1%, the Illinois Basin saw a 5% increase, and Central Appalachian coal prices climbed by 8%. On the international stage, thermal prices displayed similar disparities. Newcastle (Australia) thermal coal, which had dropped 18% in the first quarter, rose by 3% in the second. Meanwhile, Richards Bay (South Africa) thermal coal, after a 3% decline in the first quarter, continued its descent with an additional 13% fall. Metallurgical coal prices remained flat with Australian hard coking coal down 2%.

The release of the 2024 Energy Institute (formerly B.P.) Statistical Review has underscored a point we have long emphasized—despite significant investments in renewable energies, global coal consumption shows no signs of peaking. The report reveals that global consumption hit record highs last year, growing by 1.5% from 161.5 to 164 exajoules in 2023. Although consumption in North America and Europe has declined for the past 15 years, coal usage in Asian economies like China, India, and Vietnam continues to show strong growth. China's coal consumption in 2023 increased by nearly 5%, India's by almost 10%, and Vietnam's by an impressive 22%. These consumption figures are significant. Last year, India consumed 22 exajoules of coal, nearly three times the coal consumption of the entire European continent.

Another point should be highlighted: as we strive to power our world with renewables, we ironically become more dependent on coal. Nowhere is this more evident than in China, which, despite massive investments in solar, wind, and electric vehicles, continues to see strong growth in coal consumption. The July 25th Bloomberg Opinion piece underscores this point: "Ironically, coal is now getting a boost from the energy transition itself. Demand for power is rising briskly as the world moves to electrify everything—for example, putting more electric vehicles on the roads. Renewable sources are meeting the bulk of that increase, but coal is still required because it is reliable. It doesn't rely on weather conditions like hydro-power, wind, and solar do." The long-ignored intermittency issue is finally becoming evident, even to the staunch renewable advocates at Bloomberg News.

The Bloomberg article also echoes a point we have consistently stressed: low renewable energy efficiency ultimately drives additional coal consumption. "The production of what's needed for the shift toward green energy sources also is boosting demand for the fossil fuel. In China, mass production of solar photovoltaic panels, electric vehicles, and batteries is one of the main reasons why electricity consumption is rising. In Indonesia, nickel production, key for electric car batteries, consumes huge amounts of low-quality coal. Quietly, coal demand there has doubled in the last five years."

Displacing coal in the West is becoming increasingly difficult. Even Bloomberg concedes, "...the low-hanging fruit of coal-to-gas and coal-to-renewable switching in Europe and the U.S. is largely gone. For a few years, Asian consumption growth was offset by dropping demand in the West. Now, that compensating mechanism has run its course."

We firmly believe nuclear power is the only viable solution to our climate-related challenges—an incredibly efficient energy source that produces no CO₂. Ultimately, we anticipate utilities will replace coal with a combination of natural gas and nuclear-generated power. However, in the meantime, global coal demand, primarily driven by the non-OECD world, will continue to grow. Displacing coal in the West is becoming increasingly challenging—a trend ironically exacerbated by the green energy transition. We expect coal consumption to peak

within our investment lifetime, but that peak is still many years away. The recent price pullback offers another excellent buying opportunity for those who can invest in coal equities. No industry has been more deprived of capital than coal; there is no institutional ownership of coal stocks, they receive little research coverage, and their valuations are exceedingly low.

Uranium

Spot uranium began the quarter priced at \$88 per pound, gently rising over the next five weeks to a peak of \$93 by the end of the first week in May. After that, prices quietly pulled back over the subsequent seven weeks, ultimately closing the quarter at \$86. Such low volatility, we suggest, might well be the “calm before the storm.” The uranium market seems poised for potential bullish upheaval as we look ahead to the third quarter.

We encourage you to turn to the uranium section of this letter where we delve into the strong likelihood that Kazatomprom—the world’s largest uranium producer—will announce a substantial reduction in their 2025 production guidance. Additionally, we explore the burgeoning interest in building new nuclear power plants. A particularly intriguing development is unfolding in Australia, historically opposed to nuclear power, which is now inching towards a national debate over the potential construction of seven new nuclear power plants.

Agriculture

Grain investors remain incredibly bearish. Corn prices, already on the retreat, have pulled back an additional 7%, soybeans have slipped 3%, and wheat prices have slowed by 1%. The story is much the same in fertilizers, with urea (the solid form of nitrogen), phosphate, and potash declining by 17%, 12%, and 10%, respectively. Since the peak in the first quarter of 2022, following Russia’s incursion into Ukraine, grain prices have, on average, fallen 50%.

As the Northern Hemisphere’s agricultural cycle reaches its midpoint, the short-term fundamentals of global agricultural markets remain neutral. The U.S. Department of Agriculture (USDA) recently released its July World Agricultural Supply and Demand Estimates (WASDE), offering something for both the bulls and bears. On the one hand, the USDA lowered its 2024 corn-ending stocks estimate by 145 million bushels and raised domestic and export demand by 175 million bushels. On the other hand, they increased planted acres by 1.5 million. On balance, the USDA expects a slight reduction in its estimated 2025 ending stocks, now projected to reach 2.1 billion bushels.

The last time corn ending stocks were at these levels was during the 2019-2020 growing season when prices averaged \$3.75 per bushel. As noted in our previous letter, recent WASDE reports were slightly bearish. When we last wrote, corn prices were \$4.60 and we estimated prices could fall to \$3.75 – just like they did in 2019-2020. Since then, corn has dropped to \$3.95 per bushel, which is very much in line with our projection.

For soybeans, the USDA reduced planted acres by 400,000 while keeping other estimates unchanged, leading to a slight decrease in the 2025 ending stock assumption to 435 million bushels. The last time soybean ending stocks were at this level was in 2018, when prices

averaged \$10 per bushel. Soybean prices have since retreated from \$12 to \$10.80, approaching the figure noted in last quarter's letter.

The recent pullback in grain prices has again generated a pervasive mood of bearishness among traders. Corn speculators are maintaining near-record short positions. For the week ending July 9th, speculators were net short 240,000 contracts, only slightly below the record net short position of 265,000 contracts established in mid-February. Soybean traders are exhibiting similar bearishness, with the most recent data showing speculators net short 150,000 contracts— a position second only to February when speculators were net short nearly 200,000 contracts.

Counterbalancing the bearishness among speculators (often considered the “dumb money”) are near-record bullish positions by commercial traders— those who actually use the grain and are considered the “smart money.” Commercial traders now hold 250,000 net long contracts, only slightly below their all-time high of 285,000 in mid-February. A similar scenario exists in soybeans, where commercial traders are net long 160,000 contracts—a position only exceeded in mid-February when they were net long over 200,000 contracts.

Do these near-record bearish positions by speculators, offset by near-record long positions by commercials, signal an impending upheaval, possibly driven by weather, in global agricultural markets? As our readers are aware, we have been proponents of the significance of sunspot cycles and their long-term impact on global weather patterns. We are now in the third cycle—each lasting eleven years—where peak sunspot activity has waned, possibly heralding a long-term cooling trend. More crucially, we are on the brink of witnessing the recurrence of the Gleissberg cycle—an eighty-eight-year phenomenon affecting sunspot activity's amplitude. Some scientists and climatologists believe the last occurrence of the Gleissberg cycle coincided and contributed to the infamous Dust Bowl in the U.S. Midwest during the 1930s.

For those interested in exploring the nexus between sunspot cycles and global crop conditions—an intriguing and contentious subject—we enthusiastically recommend attending the Goehring & Rozencwajg Associates Biennial Fall Conference on October 21st in New York. One of our esteemed speakers will be Shawn Hackett, CEO of Hackett Financial Advisors, a firm dedicated to agricultural commodity analysis. We have been ardent followers of Mr. Hackett for many years, and he offers one of the most insightful perspectives on how changing weather trends (particularly as they relate to sunspot cycles) could influence global agricultural markets in the coming years.

Traders in global grain markets are plumbing new depths of pessimism and a potentially pivotal shift in weather trends could be on the horizon. We invite you to turn to the agricultural section of this letter where we discuss the mounting pressures already manifesting in key agricultural regions worldwide—some of which may be linked to the developing Gleissberg cycle.

Precious Metals

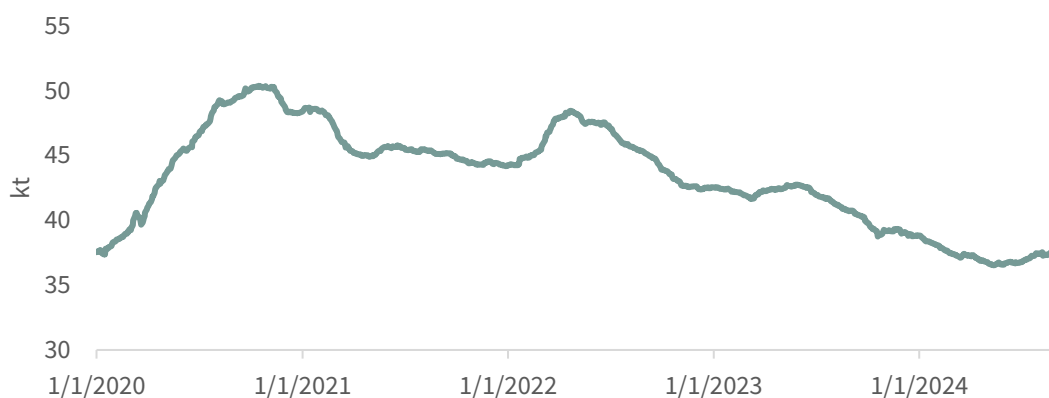
As the second quarter unfolded, gold and silver prices continued their upward march with gold advancing nearly 6% and silver surging by an impressive 17%. Among the platinum

group metals, platinum rose 9% while palladium slipped by 4%. Gold and silver mining equities mirrored the performance of their respective metals with the GDX ETF advancing 7% and the SIL ETF rising almost 14%.

Are we witnessing monumental shifts in global gold and silver markets? Since gold last peaked in the summer of 2022, Western investors, spurred by rising real interest rates, have been steadfast sellers of gold and silver. However, it now appears these investors are transitioning from sellers to buyers. As indicated in the chart below, Western investors' pace of physical gold liquidation has notably slowed and may be on the verge of reversing.

Between the summer of 2020 and May 2024, the eighteen physical ETFs we track shed nearly 1,000 tonnes of gold, a reaction to real interest rates that increased almost 3%. This scenario

FIGURE 5 Physical Gold ETF Holdings



Source: Bloomberg.

mirrors the period from late 2012 to early 2015 when Western investors liquidated over 1,100 tonnes of gold, again in response to a real interest rate hike of 3.5%.

The 1,100-tonne liquidation from 2012 to 2015 triggered a 45% gold sell-off. Contrast this with the present: despite the sale of 1,000 tonnes over the past four years, gold rose 15%, a new all-time high.

In our previous letters, we examined the key differences between these two periods—chiefly, the buying behavior of central banks. Over the past two years, central banks have turned into voracious gold buyers, more than counterbalancing the selling pressure from Western investors.

Over the last three and a half years, central banks have purchased nearly 3,000 tonnes of gold, dwarfing the 1,000 tonnes sold by ETFs. If we also account for the contraction in COMEX open interest—which we assume is primarily used to hedge physical gold—we estimate speculators liquidated an additional 1,200 tonnes. Central bank purchases have more than offset both ETF liquidations (1,000 tonnes) and COMEX trader liquidations (1,200 tonnes), culminating in a 15% increase in gold prices.

By contrast, between 2012 and the end of 2015, the combined liquidation from ETF sales (1,100 tonnes) and COMEX open interest contraction (900 tonnes) exceeded the 1,700 tonnes purchased by central banks by 300 tonnes, resulting in a 45% decline in gold prices.

The pressing question for gold investors today is whether Western investors have turned

from sellers into buyers and if central banks will continue their brisk pace of buying. Should we enter a new phase of declining real interest rates, we might witness a surge in Western gold purchases—not unlike the trend that emerged when real interest rates began to fall in 2016. The shift from gold sellers to buyers might be commencing as we speak.

Western gold buyers seem to be returning just as central banks appear to be easing their aggressive buying. After acquiring a near-record 286 tonnes of gold in the first quarter of 2024, central banks seem to have paused their purchasing spree in the second.

For a deeper dive into our views on Western gold buyers, the recent actions of central banks, and the sustained strength of retail buying in China and India—the world’s top two gold consumers—please refer to the precious metals section of this letter.

US Natural Gas Production is Plummeting

Natural gas production is plummeting—a condition noted by almost no analysts. Between December 2023 and May 2024, U.S. dry gas supply has contracted by a notable 5 billion cubic feet per day—a nearly 5% reduction. On a year-over-year basis, the decline stands at 2.2 bcf/d. The drawdown is the sharpest since the shale revolution began, excluding the 2020 COVID year. Both shale and conventional production have taken a hit, with shale output diminishing by 2.1 bcf/d and conventional sources plummeting by 2.8 bcf/d over the last five months.

In the history of shale production, the current year marks the first ever non-COVID-related year-on-year decline, with the shales recording a reduction of 1.9 bcf/d as of May. The Marcellus, the once-mighty giant, has seen its production fall by 1.1 bcf/d since December, while the Haynesville has shed 500 mmcf/d. The Permian Basin still stands as the lone growth exception, eking out a modest gain of 265 mmcf/d over the same period.

The Permian’s resilient gas production, despite a concurrent decline in crude output, raises intriguing questions. The basin’s rising gas-oil ratio has been a topic of much debate, with some analysts pointing to it as evidence of maturation—a sort of geological canary in the coal mine. The theory suggests that as a basin depletes, field pressures decline, allowing more gas to escape from solution and rise up the well bore—a phenomenon akin to a soda can being opened. A petroleum engineer would say an increase in the gas-oil ratio is a signal that declines in a basin’s oil production is rapidly approaching. Yet, we have long been skeptical of such prognostications. The Permian’s gas growth, we argued, was a simple matter of shifting rigs from the oil-rich Midland to the gas-heavy Delaware. But recent divergences between oil declines and gas growth warrants a reconsideration of our theory. Could it be that depletion is finally impacting the gas-oil ratio? If so, we should expect the Permian’s oil and gas output to both exhibit declines.

The recent downturn in U.S. gas production has been widely attributed to low prices. The Henry Hub benchmark has languished at \$2.00 per mmcf throughout 2024—a level not seen in the last quarter-century except in the nadirs of 1999, 2016, and 2020. In those years, oil prices were equally depressed, with WTI averaging \$14, \$27, and even plunging to -\$47 per barrel during the pandemic. Today, WTI trades at \$75 per barrel, yet natural gas, on an

IN THE HISTORY OF SHALE PRODUCTION, THE CURRENT YEAR MARKS THE FIRST EVER NON-COVID-RELATED YEAR-ON-YEAR DECLINE, WITH THE SHALES RECORDING A REDUCTION OF 1.9 BCF/D AS OF MAY. THE MARCELLUS, THE ONCE-MIGHTY GIANT, HAS SEEN ITS PRODUCTION FALL BY 1.1 BCF/D SINCE DECEMBER, WHILE THE HAYNESVILLE HAS SHED 500 MMCF/D. THE PERMIAN BASIN STILL STANDS AS THE LONE GROWTH EXCEPTION, Eeking OUT A MODEST GAIN OF 265 MMCF/D OVER THE SAME PERIOD.

energy-equivalent basis, remains at an 84% discount—a discount reminiscent of the all-time low in 2012.

In our previous letters, we noted the dissimilarities between today’s gas market and that of 2012. Back then, shale production was poised to soar; today, it is in retreat. The U.S., once bereft of export capabilities, now stands as the world’s largest LNG supplier.

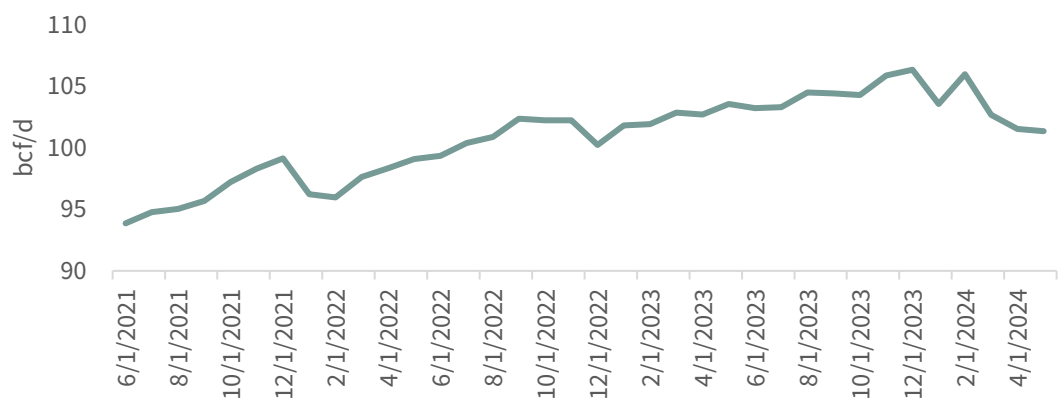
While low prices have certainly dampened drilling activity—evidenced by the gas-directed rig count, which has fallen to 100 rigs from 166 in 2022 and 200 in 2019—price alone does not tell the full story. We posit that the shale gas basins are simply running out of high-quality drilling inventory. Our proprietary neural network, developed in 2018 to analyze shale trends, has long indicated that the Marcellus, Haynesville, and Permian were approaching peak production. Now, all three basins have produced 50% of their total recoverable reserves, a harbinger of imminent declines. Particularly in the Marcellus and Haynesville, the depletion of Tier 1 drilling locations combined with falling rig counts strongly suggests that production declines should accelerate.

There is a parallel to be drawn here with the oil shales during the COVID-induced downturn. In late 2019, our neural network foresaw declines in the Bakken and Eagle Ford, with the Permian soon to follow. When oil prices collapsed, the rig count plummeted, and production followed suit. Many believed the declines would be temporary, rebounding as prices recovered. But as oil climbed past \$50, \$60, and even \$70 per barrel, it became clear that geology, not economics, was the culprit. Apart from the Permian, none of the mature shale basins were able to regain their pre-COVID highs in drilling activity.

Now, our models suggest that every shale gas basin, including the associated gas from the Permian, mirrors the Bakken and Eagle Ford in 2019. Will history repeat itself? Will higher prices fail to reverse the underlying depletion and arrest the production decline? We believe the answer is yes.

As we prepare for our upcoming investor day on October 21st in New York, we invite you

FIGURE 6 US Dry Gas Production



Source: EIA.

to join us—either in person or remotely—to delve into the latest insights from our artificial intelligence models.

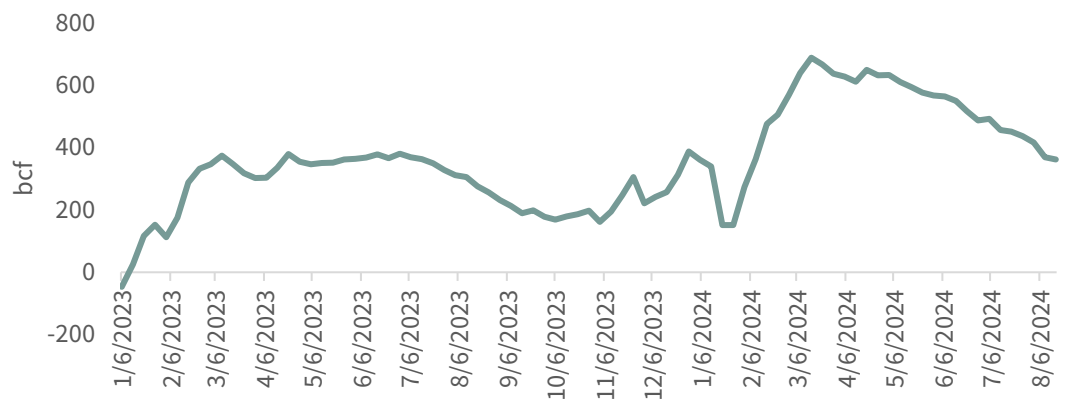
The U.S. natural gas market is now in the grip of a sharp and sustained deficit, as evidenced by inventory trends, which stands in contrast to the bearishness of investors. Following a mild winter, mid-March inventories stood nearly 700 bcf above the five-year seasonal

average—a near record. Yet, in just five months, the surplus has been halved, now standing at 325 bcf.

Once in surplus by approximately 1 bcf/d, the U.S. gas market has swung into a deficit of over 2 bcf/d—one of the sharpest reversals on record. While a hotter-than-average summer contributed to this shift, our models attribute most of the change to collapsing production. When we last wrote, we expected inventories to end July 544 bcf above average; instead, they were only 435 bcf higher than normal. By mid-August, the surplus had eroded further to just 325 bcf.

Highlighting the tightening market, August 6th saw an inventory draw of 6 bcf/d—a modest

FIGURE 7 US Natural Gas Inventories vs. 5-Year Seasonal Average



Source: EIA.

HIGHLIGHTING THE TIGHTENING MARKET, AUGUST 6TH SAW AN INVENTORY DRAW OF 6 BCF/D—A MODEST NUMBER, BUT SIGNIFICANT FOR OCCURRING DURING THE SUMMER INJECTION SEASON. SINCE 1998 THERE HAVE BEEN ONLY FOUR SUMMER WITHDRAWALS (OUT OF 312 SUMMER WEEKS). TWO OF THESE WITHDRAWALS OCCURRED IN THE BRUTALLY HOT SUMMER OF 2006, AND TWO WERE HURRICANE RELATED.

number, but significant for occurring during the summer injection season. Since 1998 there have been only four summer withdrawals (out of 312 summer weeks). Two of these withdrawals occurred in the brutally hot summer of 2006, and two were hurricane related.

Our previous forecast called for year-end inventories to be 360 bcf above average, turning into a deficit sometime in 2025. Yet, with inventories already below our bullish year-end forecast, we now expect the surplus to be completely eroded by year's end—just as new LNG capacity begins to come online. The next two years will witness the fastest growth of LNG export capacity in U.S. history. Where the industry will source the gas remains an open question.

As new LNG terminals come online, setbacks and delays are inevitable. Indeed, the first such delay has already occurred. In the second quarter, the Golden Pass joint venture between Exxon and Qatar Energy announced a three-month delay in commissioning their first train after their EPC contractor, Zachry Holdings, declared bankruptcy. The first train, expected to consume 680 mmcf/d, was initially slated for March 2025 but is now expected in June, with subsequent trains following in December 2025 and March 2026.

While delays such as this postpone one source of new short-term demand, our medium-term outlook remains unchanged. U.S. natural gas trades at an 84% discount to its energy equivalent, making it the cheapest molecule of energy on the planet. Gas for delivery in Europe remains \$12 per mcf, while Asian LNG fetches \$13.50 per mcf, compared with \$2.00 in the U.S. As new LNG demand comes online and production continues to disappoint, inventories will continue to tighten, pushing prices towards the global benchmark. We

cannot recall a more asymmetric investment opportunity than U.S. natural gas.

Uranium: A Drama in the Making

“Uranium Fever Backed by Bill Gates Betting on Nuclear Energy”

Bloomberg 7/09/2024

“One of The Last Holdouts, Australia Weighs Nuclear Power Pivot”

Bloomberg 7/10/2024

This article was first published on August 22nd 2024, ahead of Kazatomprom’s announcement on August 23rd.

Mark your calendars: August 23rd promises to be a pivotal day. That’s when Kazatomprom, the world’s leading uranium producer, will announce its half-year financial results and, more crucially, offer guidance for its 2025 production plans. This announcement is set to reverberate through the uranium markets, given Kazatomprom’s considerable influence— In 2022, Kazatomprom produced just under 55 million pounds of uranium—almost 45% of world supply

In response to robust demand from utilities, the company announced in August 2022 that it would increase its 2024 production to 65 million pounds—a nearly 10-million-pound increase. Then, in August 2023, they further upped their 2025 production guidance to an ambitious 79-80 million pounds. By 2025, the company planned to utilize 100% of its subsoil exploitation rights with the Kazakhstan government.

However, things took a twist on January 12th when Kazatomprom announced a downward revision of its 2024 guidance to 55 million pounds, chopping approximately 10 million pounds off its original target. The company blamed sulfuric acid shortages and construction delays.

Just last week, Kazatomprom updated its 2024 production outlook again, increasing guidance by 6%. While the investment community viewed this as bearish, it is noteworthy that the new 2024 target of 60 million pounds still falls 5 million pounds short of the original guidance.

This begs the question: how will the continued shortfall affect Kazatomprom’s 2025 production? Next year’s production goal, announced in 2023, remains unchanged at 79-80 million pounds. During our visit to Almaty in April, Kazatomprom remained tight-lipped about its 2025 guidance, promising that all would be revealed during their August 25th earnings release.

However, our discussions with other uranium producers and consultants in Almaty yielded

HOWEVER, THINGS TOOK A TWIST ON JANUARY 12TH WHEN KAZATOMPROM ANNOUNCED A DOWNWARD REVISION OF ITS 2024 GUIDANCE TO 55 MILLION POUNDS, CHOPPING APPROXIMATELY 10 MILLION POUNDS OFF ITS ORIGINAL TARGET. THE COMPANY BLAMED SULFURIC ACID SHORTAGES AND CONSTRUCTION DELAYS.

intriguing insights into Kazatomprom's woes. The company cited sulfuric acid shortages as a significant bottleneck and these issues persist. For instance, Cameco, during its recent second-quarter conference call, noted that its Inkai joint venture with Kazatomprom is producing 800,000 pounds less than projected—nearly 20% below expectations. Cameco pointed to sulfuric acid supply shortfalls as the primary cause of this disappointment. Cameco also highlighted that increased sulfuric acid deliveries are critical for Inkai to meet its projected 2024 production of 8.3 million pounds. We suspect these sulfuric acid challenges are affecting Kazatomprom's broader operations, bolstering our belief that their 2025 production will fall short of expectations.

Our conversations in Almaty, coupled with Kazatomprom's cryptic remarks, suggest that production shortfalls are not only due to sulfuric acid shortages but also stem from development problems at Kazatomprom's massive Budenovskoye 6 and 7 greenfield projects. The Budenovskoye projects are surrounded by controversy and were originally projected to ramp up and produce 13 million pounds of uranium by the end of 2025, representing almost 20% of Kazatomprom's output. However, the projects have reportedly been plagued by construction delays and are significantly behind schedule.

The controversy centers on the 2022 sale by two oligarchs of a 49% stake in the project to Rosatom, the Russian state uranium company. Kazakhstan's national wealth fund approved this sale—Kazatomprom's major shareholder—but without the consent of Kazatomprom's management or external shareholders. The fallout led to the resignation of several senior executives, including the chief operating officer, whose departure may now be compounding Budenovskoye's delays. The project was slated to produce 5 million pounds of uranium in 2024 and its delay likely accounts for a significant portion of Kazatomprom's 2024 shortfall. As a greenfield project, the Budenovskoye development requires extensive new infrastructure, complicating its ramp-up.

“Energy Intelligence,” a leading energy information outlet, reported on October 6th, 2023, that industry sources have expressed to them skepticism about Kazatomprom's ability to meet its timelines due to the massive infrastructure and capital requirements. One source stated, “I don't see any production from the area until at least 2026.”

Further complicating matters, downstream processing bottlenecks are now emerging. Rosatom plans to refine the uranium at the Stepnogorsk Chemical Complex in Kazakhstan, which must triple its capacity to handle Budenovskoye's output—a schedule rumored to be significantly delayed.

Two potential geological factors might also hinder Budenovskoye's development. Firstly, the uranium-rich zones are nearly twice as deep as those in Kazatomprom's other in-situ leach projects, complicating development. Secondly, the deposit may contain significantly more carbonate than Kazatomprom's other sites, which means greater acid consumption—a problem given the current acid shortage in Kazakhstan.

Kazatomprom's target is to produce 13 million pounds of uranium from Budenovskoye in 2025, but it's conceivable that we may see no production at all until 2026. Given Kazatomprom's ongoing issues with sulfuric acid shortages and the challenges at Budenovskoye, we anticipate a significant reduction in their 2025 production guidance from the original 79-80 million pounds.

In our last letter, we explored the extent to which Kazatomprom's 2024 production increase—almost 10 million pounds—was sold forward and whether, if production disappoints, the company will make up the shortfall either by purchasing on the open market or selling from inventory. This question remains unanswered following our April meeting in Almaty. Should 2025 guidance be substantially reduced, as we suspect it will be, the question of how much of this projected increase has been sold forward will resurface.

We hope Kazatomprom's August 23th announcement will clear up these uncertainties.

The anticipated increase in uranium supply, first projected two years ago, has yet to materialize. Kazatomprom's substantial 2024 production targets have not been met and we believe the 2025 guidance will be drastically reduced. The uranium market is currently in deficit. As we noted in our last letter, reactor demand is projected to outstrip mine supply by 170 million pounds, up from 145 million pounds in previous years, driven by new nuclear reactors starting up and extending the operating lives of older plants.

Any disappointment in Kazakhstan's uranium production next year will only exacerbate this structural deficit. If Kazatomprom reduces its guidance, as we anticipate, the uranium market could very well turn chaotic as buyers are forced to acknowledge the extent of the deficit. We believe the uranium bull market is far from over. Production shortfalls will fuel the next phase.

On the demand side, the most intriguing development comes from Down Under. Historically a staunch opponent of nuclear power, Australia may be rethinking its stance. Between 1952 and 1957, the United Kingdom conducted 12 major nuclear weapons tests in Australia, including the two Emu Field tests conducted on the mainland in 1953. French nuclear tests in the Pacific in the early 1970s galvanized the country's anti-nuclear sentiment. Since the 1970s, Australia has heavily restricted uranium mine development and has prohibited the construction of any new nuclear power plants since 1998.

Yet, Australian public opinion on nuclear energy may be shifting. Last month, Australia's main opposition party unveiled plans to build seven nuclear power plants if it returned to power. These plants would be constructed on former coal power sites starting in 2035. The current Labor government came to power in 2022, pledging to slash Australian greenhouse gas emissions by 2030. Since then, Australia has invested heavily in renewable energy. Unfortunately, due to renewable energy's poor energy efficiency and high cost, Australian electricity costs skyrocketed. As more and more Australians have come to realize the shortcomings of wind and solar, a renewed interest in nuclear power has emerged as a realistic option to help achieve the country's stringent CO2 reduction targets.

The proposal has already ignited controversy with familiar arguments resurfacing about nuclear power's high construction costs and the flawed belief that renewables can provide ample low-cost energy.

Politicians have pushed for SMRs or small modular reactors to address the argument about high capital costs. The benefits of SMRs, outlined in many of our letters, could sidestep the criticisms of excessive capital costs associated with nuclear energy.

How this political drama will unfold is anyone's guess, but it is fascinating that a nation with such strong anti-nuclear credentials is now seriously considering investing in nuclear power. Slowly but surely, the world is realizing that to meet future CO2 reduction goals, signifi-

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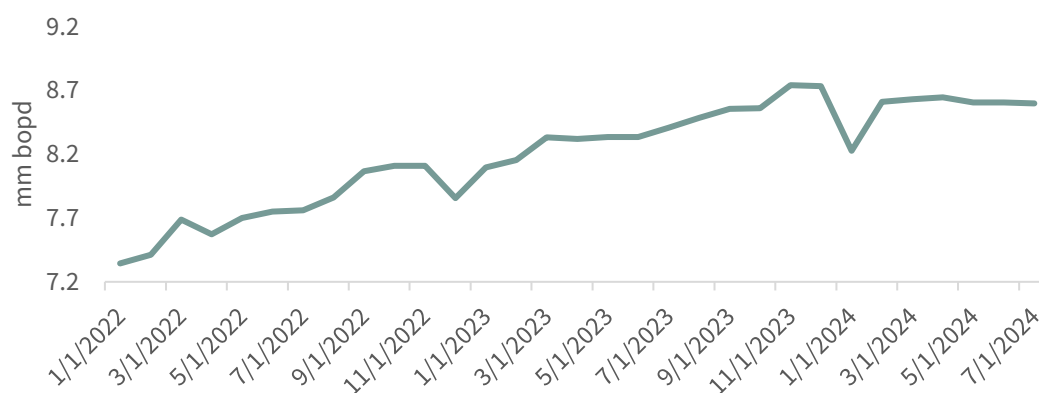
The Oil Shales Continue To Decline

The saga of the U.S. shale oil boom appears to have reached its end.

After cresting at a lofty 8.74 million barrels per day (m b/d) last December, shale production now finds itself in retreat, standing at 8.59 m b/d as of July. This 150,000 b/d decline, while seemingly modest, marks the most precipitous seven-month drop in shale production since the COVID-induced curtailments of 2020, and more poignantly, since 2016, when West Texas Intermediate (WTI) traded at a mere \$27 per barrel. Year-over-year growth in shale output has slowed to a crawl, adding less than 200,000 b/d—a rate not seen since the dark days of 2016, COVID excluded.

This once-mighty source of non-OPEC supply growth is no more.

FIGURE 8 US Tight Oil Production



Source: EIA.

To the casual observer, this turn of events might seem unexpected. But for those who have been paying attention, the writing has long been on the wall. With the exception of the Permian basin, every other major shale oil field in the United States has been in decline for years. The Bakken, for instance, has shed 300,000 b/d since its October 2019 peak, while the Eagle Ford languishes nearly 700,000 b/d below its apex reached nearly a decade ago. The Permian, the last bastion of U.S. shale vitality, has now begun to falter. Since its December 2023 peak, it has slipped by 10,000 b/d, and our models forecast that this decline is only starting.

In 2018, we unveiled our proprietary artificial intelligence deep neural network, trained on over 70,000 shale oil wells. Our model, with its millions of “neurons,” allowed us to model shale production with unprecedented clarity. We discovered that the industry’s vaunted productivity gains from 2016 to 2018 were not the result of revolutionary drilling techniques but rather the exploitation of the most productive “sweet spots” in the fields. In the parlance of the hard-rock mining industry, the oil industry was “high grading” its drilling inventory.

In its zeal for production growth, the industry was rapidly exhausting its best assets.

Armed with this knowledge, we were able to calculate the total recoverable reserves for each shale basin and predict when production might peak. In the conventional oil world, Hubbert's Peak theory teaches that production will crest and decline once half of a field's recoverable reserves have been extracted. Our models confirmed that the same fate awaited the shale fields. The Barnett and Fayetteville shale gas fields had already peaked and begun their descent. On the oil side, the Eagle Ford, which had already peaked when we first conducted our analysis, followed the same pattern.

We accurately predicted that the Bakken would roll over in 2019 and that the Permian would follow suit in 2025 or 2026. Subsequent data led us to revise our Permian forecast to 2024, a prediction that now seems to be playing out. The brief resurgence in the Bakken last year, driven by a one-time liquidation of drilled but uncompleted wells (DUCs), has proven to be a fleeting reprieve, and the field is once again in decline.

As we approach our investor day on October 21st, 2024, in New York City (and virtually), we will unveil the latest updates to our artificial intelligence models. Our focus will be on the factors driving declining per-well productivity and the future trajectory of shale production. We will also assess the remaining high-quality drilling locations in each basin and identify the companies that control these areas. This presentation, the most significant update to our neural network in years, promises to be illuminating for followers of the oil industry.

Our early analysis suggests that the declines witnessed so far this year are but a prelude to steeper drops ahead.

With the U.S. shales now in retreat, the oil market is entering a new era. The largest engine of non-OPEC supply growth over the past fifteen years is sputtering. History offers parallels. By 1970, U.S. conventional production, long the mainstay of non-OPEC supply growth, peaked and rolled over, paving the way for OPEC to gain market share and pricing power. The oil crises of the 1970s, with their attendant price spikes, were the result. From trough to peak, crude prices rose ten-fold from 1970 to 1980. Similarly, by 2003, the North Sea and Mexico, the last bastions of non-OPEC supply growth, began to wane, once again shifting market share and pricing power to OPEC. Although no embargo followed, OPEC's unexpected production cuts in 2005, amid a tight crude market, sent prices soaring from \$14 per barrel in 1999 to a staggering \$145 per barrel in 2008.

As oil prices plummeted to \$20 per barrel during the depths of the COVID-induced demand collapse, we would not be surprised to see them rise tenfold in the current cycle, perhaps reaching \$200 per barrel.

Yet, despite these seismic shifts, investors remain oblivious. Since 2022, the shares outstanding of the XLE ETF, which tracks large-cap energy companies, have fallen by 20%. Investors have redeemed another 5% of shares so far this year. The XOP ETF, tracking independent exploration and production companies, has seen its shares outstanding plummet by 60% since mid-2021, with a 25% drop this year alone. Speculative net long positions in the WTI crude contract have similarly fallen 60% since 2021, now resting at levels last seen in 2016 when oil traded at \$27 per barrel.

This pervasive bearishness is misplaced and presents investors with huge opportunities.

In 2016, when speculative net long positions were at similar levels, the oil market was awash in surplus. Supply far outstripped demand, swelling OECD inventories by over 450 million barrels between mid-2014 and mid-2016. In contrast, over the past two years, the oil market has been largely balanced, with OECD inventories growing by only 45 million barrels.

While today's oil market is not as tight as it was two years ago, the balance is precarious. From the COVID-induced high in June 2020, oil inventories plunged by nearly 800 million barrels over the next two years, equivalent to a draw of 1 m b/d. Comparing the third quarter of 2020 to the second quarter of 2022 with the same period from 2022 to 2024 reveals the shifting dynamics. Demand grew by 4.6 m b/d, reaching a new all-time high as the world emerged from lockdowns. However, supply outpaced demand, growing by 6.4 m b/d. OPEC and Russia restored 2.7 m b/d of curtailed production, while the U.S. (including NGLs) added another 2.6 m b/d. Latin America, led by Brazil, contributed 1 m b/d, while biofuels and refinery processing gains added 400,000 b/d. The result was a shift from a 1.1 m b/d deficit to a balanced market.

U.S. inventories, the largest component of OECD stockpiles, tell a similar tale. After collapsing by 385 million barrels between June 2020 and 2022, equivalent to 525,000 b/d, core U.S. inventories drew down by only 70 million barrels between June 2022 and 2024, a modest draw of less than 100,000 b/d. In the six weeks following June 30th, 2024, core inventories drew by 24 million barrels—inline with the seasonal average, indicating that the global oil market remains balanced.

However, our models suggest that today's balance will soon give way to deficit as the year progresses. The International Energy Agency (IEA), in its latest Oil Market Report, projects a significant deficit in the third quarter, followed by a balanced market in the fourth quarter. For the second half of the year, the IEA expects demand to average 103.9 m b/d—1.7 m b/d higher than the first half, consistent with seasonal trends.

Yet, “missing barrels” have once again made their presence felt in the IEA's balances. As our readers know, “missing barrels” occur when the IEA's balance sheet fails to account for all crude production, leading to unaccounted-for volumes that were neither consumed nor placed into inventories. These anomalies are often resolved when the IEA revises demand estimates higher, and we expect a similar outcome this time. In the second quarter, the IEA reported 300,000 b/d of “missing barrels.” Should these persist into the second half, demand may reach 104.2 m b/d.

On the supply side, the IEA projects non-OPEC+ production to rise in the second half by a robust 400,000 b/d compared with July, as Brazil and Guyana ramp up new offshore projects. We believe this timeline is overly optimistic. Additionally, the IEA expects U.S. production to grow by 100,000 b/d in the fourth quarter relative to current levels. If U.S. shale declines persist, as we anticipate, the IEA could be off by 100,000 b/d or more.

Taking all factors into account, we estimate the oil market will experience an average deficit of nearly 800,000 b/d in both quarters of the second half, drawing down inventories at twice the rate projected by the IEA.

As we cast our gaze toward the horizon of 2025, it's worth noting the International Energy Agency's (IEA) outlook—a view that many have deemed pessimistic, predicting a 1.3 million barrels per day (m b/d) surplus. We beg to differ. From the vantage point of a balanced 2024,

THE IEA ALSO PREDICTS THAT U.S. PRODUCTION WILL SWELL BY 600,000 B/D NEXT YEAR—A FORECAST WE FIND OVERLY OPTIMISTIC. SHOULD U.S. PRODUCTION MERELY HOLD STEADY AT CURRENT LEVELS—A BEST-CASE SCENARIO IN OUR VIEW—IT WOULD RESULT IN A MEAGER 200,000 B/D INCREASE FOR THE FULL YEAR OF 2025. THIS WOULD LEAVE A SHORTFALL OF 400,000 B/D RELATIVE TO THE IEA'S OPTIMISTIC PROJECTIONS.

the IEA envisions a paltry 900,000 b/d uptick in demand—a dismal forecast, only surpassed in its dreariness by the pandemic-stricken years. It's worth remembering that the IEA has a notorious track record of underestimating demand over the past two decades, a recurring theme in our pages. Recent history shows that the IEA has revised its initial demand estimates upward by an average of 500,000 b/d annually. Given the current backdrop of “missing barrels,” we anticipate that 2025 will compel the IEA to once again revise its demand forecasts higher.

The IEA also predicts that U.S. production will swell by 600,000 b/d next year—a forecast we find overly optimistic. Should U.S. production merely hold steady at current levels—a best-case scenario in our view—it would result in a meager 200,000 b/d increase for the full year of 2025. This would leave a shortfall of 400,000 b/d relative to the IEA's optimistic projections.

We also harbor concerns about the IEA's expectations for non-OPEC+ production outside the U.S. The agency anticipates a 1 m b/d growth next year, driven by continued successes in Brazil and Guyana. The Yellowtail Phase IV project in Guyana, for example, is expected to add 250,000 b/d, while Brazil's Buzios 5 and 6 fields are each forecast to contribute an additional 200,000 b/d. Other Brazilian ventures are slated to add another 500,000 b/d collectively, and Canada's Mildred Lake expansion is expected to bring in 140,000 b/d.

These projections, while impressive on paper, overlook the persistent and unyielding force of depletion. Non-OPEC+ production outside the U.S. averages 26 m b/d and typically declines at a rate of just over 3% per year. Even with new projects adding an average of 900,000 b/d annually over the past several years, net production growth from this group has barely eked out a 100,000 b/d increase each year.

The discrepancy lies, as always, in depletion. Adjusting for the timing of startups, we estimate that non-OPEC+ ex-U.S. major projects will add 1.2 m b/d of gross new supply next year. For this to translate into 1 m b/d of net production growth, the base decline rate would have to drop from 3% to an implausible 0.8%—a figure that would be the lowest in our records by a wide margin. Should the base decline remain at 3%, as we expect, net production from non-OPEC+ countries outside the U.S. might only grow by 400,000 b/d in 2025, falling short by nearly 600,000 b/d.

Instead of the predicted 1.3 m b/d surplus, we foresee the oil market shifting into a 150,000 b/d deficit, with the decline in shale production accelerating the shortfall.

The latter half of 2024 will be pivotal, with critical data flows setting the stage for what's to come. We look forward to sharing our latest insights at our October conference.

A lingering undercurrent within the oil industry is the chronic underinvestment in its assets. Capital spending, when adjusted for inflation, is expected to remain 35% below the levels seen a decade ago, aligning with 2019's modest outlays. The industry's conventional discoveries in 2023 amounted to a mere 9 billion barrels, the lowest since 2010. Over the past four years, annual conventional discoveries have averaged 11 billion barrels—a 30% decline from the 2010-2014 period. In comparison, we consume 37 billion barrels of oil per year. Conventional production failed to grow over the past decade, and it seems increasingly improbable that it will do so in the decade ahead. The U.S. shales, once the lone bright spot, are now dimming, leaving little hope for production growth.

Our view remains steadfast: the cessation of shale growth will likely steer oil companies back offshore. The current dayrate structure, while sufficient to generate healthy cash flows for drilling companies, is far from adequate to spur newbuilds. Moreover, many shipyards have shifted away from the oil and gas sector after years of tepid demand. A new offshore bull market is likely emerging. As shale production wanes and high-quality drilling opportunities become scarcer, we anticipate reallocating more of our investments from the shales to the offshore sector.

Copper's Crossroads: Navigating the Squeeze, Supply Surge, and China's Demand Dilemma

Several forces are at play in global copper markets. Most notably, a severe short squeeze developed in copper futures contracts traded on the New York COMEX. This squeeze sent the nearby copper futures up by almost 40%. On May 21st, copper prices spiked to a record-breaking \$5.12 per pound, with COMEX futures trading at a never-before-seen 55-cent premium over the price in London. Before the squeeze, hedge funds were extremely bearish toward copper. The dominant narrative suggested that China's property development woes would dampen copper consumption. In response, U.S.-based hedge funds and trend following algorithmic traders turned to the COMEX futures market to express their views.

Consider this: by the end of March, speculators' net short interest on the COMEX reached 33,000 contracts. While this level of speculative short interest has been surpassed—notably at the bear market bottom in early 2016 when copper prices fell below \$2.00 per pound and again in 2019 during New York's repo crisis—today's situation is unique. Copper stocks in warehouses across COMEX, the London Metal Exchange (LME), and the Shanghai Metals Exchange were nearly twice as large during those years compared to the sparse levels at the start of 2024. We have long cautioned that such low levels of easily mobilized copper stocks could ignite a short squeeze at any moment. We believe a catalyst might be the formation of the new Sprott Physical Copper Trust, announced in early March, which struck fear into the shorts, forcing them to cover.

With the short squeeze now behind us, hedge funds have swung from holding significant short positions to establishing near-record long positions on the COMEX. Copper prices have since retreated by a substantial 20% from their peaks.

As we reflect on recent events, investors must ponder: is this the last great buying opportunity for copper, or a warning of a bearish shift in fundamentals?

Here are a few thoughts to consider:

Historically, short squeezes typically occur at the tail end of extended bull markets. A short squeeze so early in a bull market is quite unusual. The last significant copper squeeze occurred in early 2006, well into the bull run that had, at that point, been rolling for five years. Back then, copper prices peaked above \$4.00 per pound in the first quarter of 2006, but 95% of the copper bull market had already run its course by then. Copper prices hit new all-time highs in 2010, but only about 10% higher than the peak during the 2006 short squeeze.

Consider the example of Freeport-McMoRan Copper & Gold (FCX), a copper bellwether.

Between its low in 2002 and its peak during the short squeeze in early 2006, FCX rose over tenfold. Although the stock continued to appreciate post-squeeze, its gains were modest. From its 2006 interim peak at \$24, FCX doubled to \$46 by 2010. A similar pattern emerged with Southern Copper (SCCO), another stalwart in the copper sector. From its low in 2001 to 2006, SCCO saw a staggering twentyfold increase. While there were future gains, they paled in comparison. Between 2006 and its ultimate peak in 2010, SCCO rose fourfold—a handsome return, to be sure, but not quite like the meteoric rise between 2001 and 2006.

The 2006 short squeeze, while not quite marking the end of the bull market, signaled that the lion's share of gains were behind you. Given today's rampant bullish consensus (except the hedge fund shorts who missed the mark earlier this year), it's a roadmap investors should take to heart as we progress through this decade.

In the short term, underlying copper fundamentals remain bullish, but some bearish trends are surfacing. First, we are witnessing a surge in mine supply that has gone largely unreported by analysts. The last significant rise in mine supply ended in 2016, just as copper prices bottomed at \$2 per pound. Since then, mine supply growth has slowed to a modest 1% annually. However, in the last six months, we've seen a notable uptick in growth. According to the World Bureau of Metal Statistics (WBMS), copper mine supply surged by over 7% in the first five months of 2024 alone—a figure that challenges the consensus view that copper mine supply cannot grow.

Where is this growth coming from?

In the first four months of 2024, mine supply expanded by 470,000 tonnes year-on-year, primarily driven by a 250,000-tonne increase from the Democratic Republic of Congo (DRC). In past letters, we have discussed the DRC's significant potential, particularly Ivanhoe Mines' Kamoia-Kakula project and their recent discovery in the Western Foreland basin.

In just two and a half years, Kamoia-Kakula added 400,000 tonnes of new mine production to global copper balances. In its Stage 3 expansion, Kamoia-Kakula will contribute another 200,000 tonnes next year. Given Ivanhoe's successful initial drilling results in the Western Foreland, it's not inconceivable that production from that area could eventually rival Kamoia-Kakula's output later this decade. For more on the Foreland discoveries, refer to our fourth-quarter 2023 letter, where we discuss Ivanhoe's recently released drilling results.

However, the recent surge in DRC's copper production has not come from Kamoia-Kakula but rather the expansion of China Molybdenum's massive Tenke Fungurume and the newly commissioned Kisanfu mines. In 2023, both mines produced 390,000 tonnes of copper. Last July, China Molybdenum announced that royalty issues with Gecamines, the DRC national copper producer, had been resolved. In response, China Molybdenum announced plans for significant expansions at both mines. In 2024, production from both mines is expected to increase to 600,000 tonnes. China Molybdenum also stated that additional production expansions would be considered if long-term power agreements were secured.

The consensus opinion suggests that, due to various constraints, copper production will show little growth between now and 2035. It's a topic we are intimately familiar with. For example, in the introductory essay of our 1st Q 2021 letter, "The Problem with Copper Supply," we outlined the challenges of slowing copper supply growth.

But is the consensus missing something? Does the copper industry still have the capacity

to grow? We meet with many copper companies and are impressed by the robust development projects in their portfolios. In future letters, we will revisit the issue of copper mine supply and where it might be headed. The recent surge in DRC production might be a one-off event that cannot be repeated. In future letters, we will attempt to answer that question.

So far, the 2024 surge in mine production has been met with a corresponding rise in copper demand. According to WBMS data, global copper demand increased by 6.7% in the first four months of 2024 compared to 2023, mostly absorbing the surge in global supply. However, upon closer inspection, nearly all of this growth came from a single country—China.

Of the 590,000-tonne increase in copper demand this year, nearly 550,000 tonnes have been attributed to China. Outside of China, the rest of the world has shown little growth. India recorded 5% growth, but Indonesia, which saw a 40% surge in copper demand last year, has experienced an unexpected 30% decline in copper consumption this year.

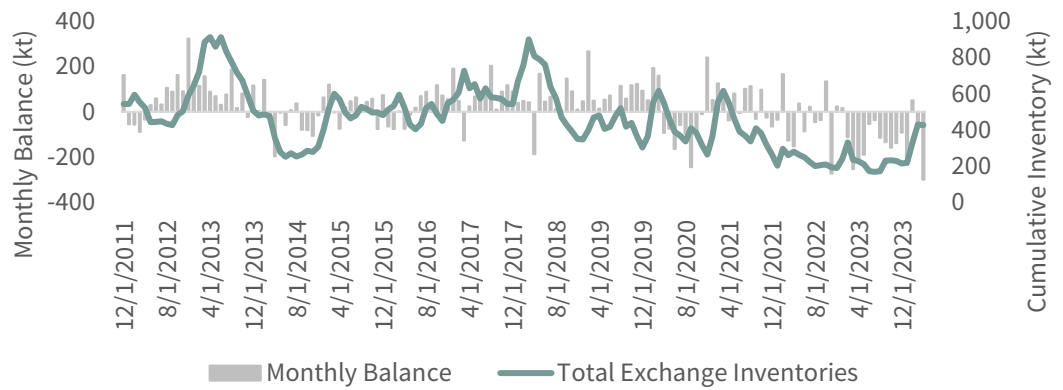
Over the years, we consistently refuted the consensus opinion that China was over-consuming copper. Despite the analytical community's assertions to the contrary, we have always believed, based on our models, that Chinese copper consumption was in line with its per capita GDP. However, China might now be reaching an inflection point regarding the strength of its copper demand. In last quarter's letter, we noted that if China wished to avoid the "middle-income trap"—defined as reaching a per capita GDP figure of \$18,000 to \$20,000—then installed copper in China would need to increase from 260 pounds per person to 360 pounds or by 64 mm tonnes. If China grows by 5% annually, the country will reach \$19,000 per capita GDP by 2035, necessitating the consumption of 15 million tonnes of copper per year to achieve these levels. China's copper demand trends remain significant, but the substantial year-over-year increases needed to sustain per-capita growth in the Chinese economy may be nearing an end. China consumed 16.5 million tonnes of copper in 2023 and its consumption in 2024 could exceed 18 million tonnes if growth rates continue—a level far above the 15 million tonnes required to maintain per capita GDP growth.

For years now, we've been singing a familiar refrain: China's copper consumption has been closely in line with our projections and bearish predictions about a downturn in Chinese demand were simply off the mark. However, a twist in the plot may be upon us. Our models now suggest that China is indeed over-consuming copper. This surge in demand is likely fueled by substantial investments in renewable energy, which are driving China's copper appetite beyond what our models had anticipated. In our next letter, we plan to quantify precisely how much of China's copper is consumed by the burgeoning renewables sector and how much continues to feed the "old" economy. But let us not mince words—China's overconsumption, relative to our models, introduces a potentially bearish factor into global copper markets that warrants scrutiny.

And finally, while the WBMS data suggests that global copper markets are mired in a structural deficit, it's hard not to notice a shift in the tide. The once-declining warehouse inventories of the Big Three—COMEX, Shanghai, and LME—have now breached their long-standing downtrend since 2018 and are on the rise.

This emerging divergence between inventory levels and our fundamental supply-demand data is intriguing. Below, you'll find a bar chart mapping the monthly surplus or deficit in global copper markets derived from WBMS data from 2011.

FIGURE 9 Copper Balances & Cumulative Inventories



Source: WBMS and Bloomberg.

Alongside it is a line graph tracking the combined copper inventory of the COMEX, LME, and Shanghai exchanges. As history shows, when the copper market swings from a significant surplus—like the one in the first quarter of 2013—to a deficit, as seen from the end of 2014 into the first quarter of 2015, inventories on the three exchanges decline. Conversely, inventories on these exchanges accumulate when the copper market moves into surplus, as it did from the second quarter of 2015 to the first quarter of 2018. From 2018 until now, the copper market has moved into a structural deficit—clearly evidenced by the negative bars in the chart—and inventories steadily declined, reaching near-record lows by the fourth quarter of 2023, leading to March’s copper market short squeeze.

Since the beginning of this year, the WBMS data tells us a tale of a copper market still trading in a deficit. But here’s where it gets intriguing: exchange inventories are growing instead of drawing. After hitting rock bottom at 170,000 tonnes at the start of last year’s fourth quarter, these inventories have made a remarkable comeback, now at 560,000 tonnes. Yet, while this inventory surge unfolds, WBMS data indicates that since October, only one month—March—has recorded a surplus, with the cumulative deficit nearing 1 million tonnes since October. This deficit, however, now finds itself at odds with the burgeoning inventory data.

It’s a situation we will be watching closely. As mentioned, China is over-consuming copper for the first time since 2000. Are the property developer woes in China finally impacting the country’s economic growth? Real-time inventory data now suggest that real estate issues might finally be taking an economic toll.

We remain bullish on copper in the short term; however, cracks may already be forming in the wildly optimistic copper price scenarios touted by large segments of the global commodity analytical community. Copper mine supply is showing robust growth and China’s copper consumption—which now accounts for nearly 60% of global demand—could be poised to slow for the first time in twenty-five years. Furthermore, exchange inventories are showing strong growth, contradicting the strong underlying fundamentals.

We will continue monitoring all incoming data closely—from both supply and demand perspectives—and update our viewpoint in future letters.

A Precarious Grain Market

Dust Bowl—a term that conjures up images of swirling dust clouds, parched earth, and the gritty resilience of those who lived through one of the most trying periods in American history. Beginning in 1930, Mother Nature decided to throw a tantrum over the U.S. Midwest, enveloping the region in a relentless drought that stretched on for nearly a decade.

Beginning in 1930, this unforgiving dry spell transformed vast stretches of the heartland into a veritable wasteland. As the years passed, massive dust storms carried the remnants of precious topsoil far and wide—even reaching the urban sanctuaries of New York City and Washington, D.C. The impact on the economy and the mass migration westward were so profound that they inspired John Steinbeck's novel, *The Grapes of Wrath*.

And while the nation grappled with economic turmoil, the heavens decided to turn up the heat. Summers in the '30s were scorchers across the Plains, the Upper Midwest, and the Great Lakes. Last quarter, we compared the sizzling temperatures of the 1930s to our recent heat waves. For instance, Des Moines, Iowa, has recorded only six days in the past decade when the mercury hit 100 degrees Fahrenheit. In contrast, Des Moines endured a scorching eighty days of 100-degree temperatures in the 1930s, including thirty-one blistering days in 1934 and thirty in 1936.

Now, let's toss a bit of controversy into the mix. Some climatologists have pointed fingers at the Gleissberg cycle—a solar phenomenon occurring every eighty-eight years—as the potential catalyst behind these meteorological anomalies. This cycle, first identified in 1862, represents a fluctuation in the strength of the standard eleven-year solar cycle. Some astrophysicists suggest that the Gleissberg cycle results from a gentle swaying of the sun's magnetic poles, repeating every eight Schwabe cycles.

The mid-1930s, our Dust Bowl era, coincided with one such Gleissberg cycle. In the late 1840s, the cycle before that was marked by severe drought, as indicated by tree ring studies in the Midwest. With an 88-year gap, the next Gleissberg cycle should unfold right before our eyes.

In previous letters, we highlighted the Midwest's brush with drought-like conditions in recent years, suggesting a setup for a potential Dust Bowl sequel, perhaps triggered by the Gleissberg cycle. But, as they say, life is full of surprises. New data has surfaced that challenges our original assumptions and shifts the spotlight to other regions.

The U.S. Midwest has recently enjoyed significant rainfall, replenishing the dwindled subsoil moisture levels that had developed over the past few years. If the Gleissberg cycle is stirring the cosmic pot, this newfound moisture could stave off another extreme drought.

Meanwhile, the spotlight has shifted to other crucial agricultural powerhouses. Brazil, Ukraine, and Russia—significant players in the global grain market—are grappling with extended dry spells, a point often overlooked by market commentators. These droughts pose an intriguing question: Can the Gleissberg cycle wreak havoc beyond the U.S. Midwest? And are its effects already manifesting in distant grain-growing belts?

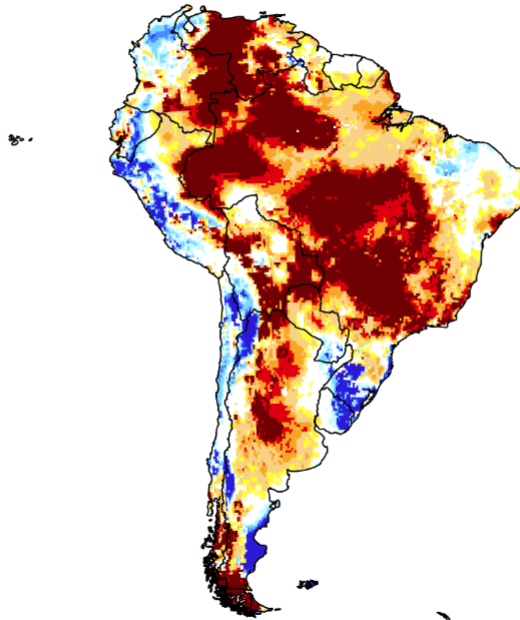
To appreciate the severity of the situation, please look closely at the charts below, which vividly depict the dire drought conditions afflicting Brazil, Ukraine, and Russia. If the Gleissberg cycle become the dominant manipulating weather pattern across these important

FIGURE 10a South American Drought Conditions



GRACE-Based Shallow Groundwater Drought Indicator

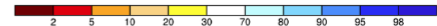
August 26, 2024



Wetness percentiles are relative to the period 1948-2012

Cell Resolution 0.25 degrees

Projection of this document is Albers Equal Area (South America)



Wetness Percentile
<https://nasagrace.unl.edu>

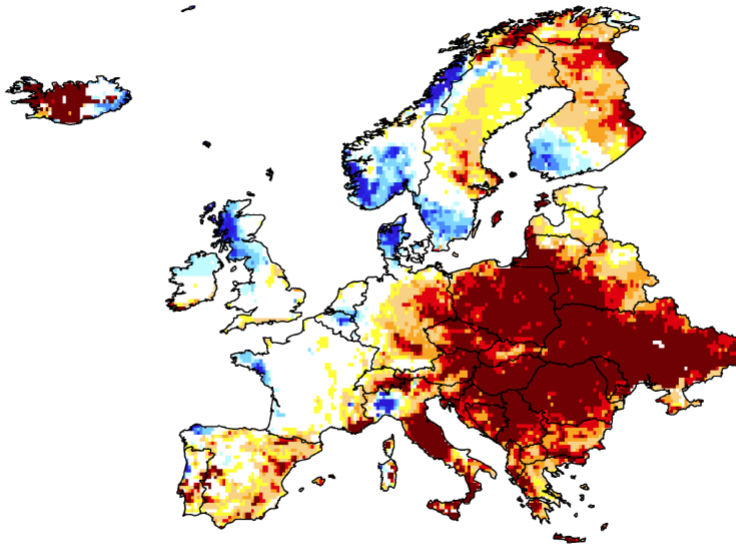
Source: NASA.

FIGURE 10b Europe Drought Conditions



GRACE-Based Shallow Groundwater Drought Indicator

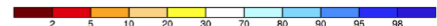
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Projection of this document is Patterson (World)



Wetness Percentile
<https://nasagrace.unl.edu>

Source: NASA.

grain-growing regions, agricultural impacts could rival those of the Dust Bowl era.

Consider this: Brazil, Ukraine, and Russia account for a hefty 15% of the world's coarse grains supply (which includes corn), compared to the U.S.'s 25%. In wheat they represent 20% of the global supply, compared to a mere 6% here in the US. Regarding soybeans, Brazil towers over the rest, producing 40% of the world's supply, with the U.S. trailing at 30%.

Are the escalating drought conditions in Brazil, Ukraine, and Russia tied to the Gleissberg cycle? We'll closely follow this narrative as the 2024 northern hemisphere growing season unfolds and the 2025 southern hemisphere season approaches.

As mentioned in the "Market Commentary" section, we have a treat in store for those with a penchant for solar cycles and their effects on global agricultural markets. We're thrilled to announce that Shawn Hackett, the esteemed agricultural market commentator in high regard here at Goehring & Rozencwajg, will be addressing our upcoming investor day in New York City on October 21st. Mr. Hackett is a keen student regarding solar cycles and his insights on the Gleissberg cycle's potential impact on global agricultural markets are not to be missed. We've followed his work for years and we assure you that his presentation will be one of the most important you hear this year. We urge you to attend in person or, if that's not feasible, to tune into the webcast.

Gold: What Happens if Interest Rates Fall?

Inflationary pressure is easing and authorities at the Federal Reserve have revised talks about possibly cutting interest rates. If that happens, we could see declines in real interest rates after three years of steady hikes.

History tells us that falling real rates will impact Western gold investors in very big ways. The prospect of falling real interest rates may already be exciting Western gold buyers. Since the liquidation spree ended in mid-May, Westerners, in the physical gold ETF's we track, have accumulated 40 tonnes of gold.

What might happen if real interest rates move lower? History tells us Westerners will aggressively become gold buyers. Let's take a stroll down memory lane. Gold hit a low of \$1,060 at the tail end of 2015 when real interest rates were zero. Fast forward to mid-2017, inflation nudged over 2%, short-term rates climbed to 1%, and real rates slipped into negative territory. The result? Western investors went on a gold shopping spree, snapping up nearly 700 tonnes of gold in eighteen months.

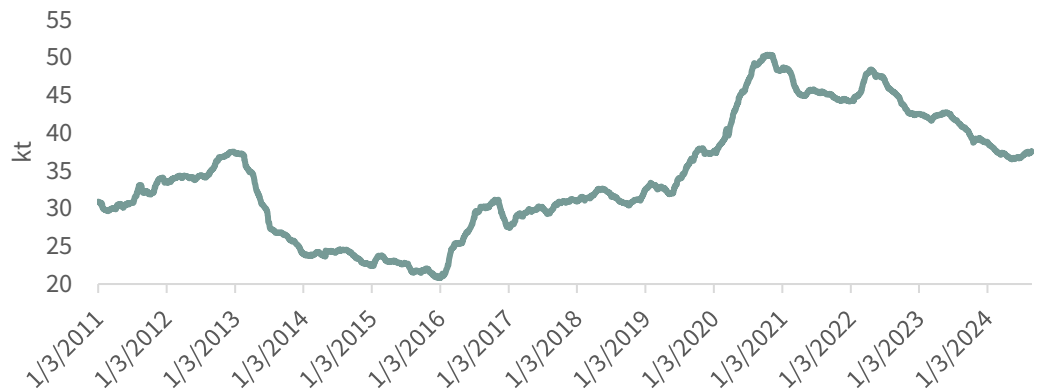
Then came 2017. The Fed started raising rates early in the year which eventually caused real rates to turn positive by 2019. A hiccup in the Treasury bill repo market in the summer of 2019 forced the Fed to drop rates again, sending real rates tumbling.

In response to falling real rates, Western demand for gold surged with 1,300 tonnes added in just twelve months. Between late 2015 and the summer of 2020, gold prices doubled as these ETFs accumulated a whopping 2,000 tonnes. If we're entering a new era of falling real

interest rates, we might see a gold rush reminiscent of 2016 and 2019.

Incidentally, Western gold buyers are waking up just as central banks seem to be cooling off their aggressive buying. After setting a record in Q1 2024 with 300 tonnes, central bank purchases slowed to 183 tonnes in Q2—down 30% from the previous quarter, though still 6% higher than Q2 2023.

FIGURE 11 Physical Gold ETF Holdings



Source: Bloomberg.

Notably, China seems to have hit the pause button. After averaging 18 tonnes per month over the past seventeen months, Chinese buying slowed to only 2 tonnes in April and nothing in May or June, likely due to the price surge starting in April. Singapore also cashed in on the price hike, selling 12 tonnes in June after aggressively accumulating over the past several quarters.

But India? They're still in the game, adding 19 tonnes in Q2, bringing their 2024 total to 37 tonnes.

This price hike has predictably prompted some price-sensitive players like China and Singapore to pull back. But here's where things get interesting: Chinese and Indian retail investors continue their unusual behavior. Traditionally, Asian buyers wait for prices to dip before buying, unlike their Western counterparts who dive into strength. Yet, they've acted more like Western buyers over the last six months.

China's retail gold investment demand surged 60% year-over-year in Q2, with India's up 46%. With gold prices up over 20% year-over-year, such buying strength is an anomaly which has been noted multiple times by the World Gold Council. These investors continue defying tradition for the second quarter in a row, buying more gold despite substantial price hikes. Are they adopting Western habits-- or do they believe gold at \$2,400 per ounce is still a bargain? We're keeping a close eye on this trend.

Even as central bank demand might ease, the resurgence of Western investor buying, driven by falling real rates, is positive for gold. Combine that with the shifting buying habits of Eastern retail gold investors, and it looks like the great gold bull market of the 2020s has begun.

But here's an interesting divergence: while interest in physical gold is rising, investors seem to be giving gold equities the cold shoulder. The GDX gold-stock ETF—a clear indicator

of investor sentiment—shows open interest declining, even as gold prices advance strongly. GDx shares outstanding have dropped by nearly 10% in the last four months alone. It's a curious situation, given the gold price has advanced almost 15%.

This investor disinterest has left us with some of the cheapest gold stock valuations in our thirty-five-year natural resource investment career. For those curious about how undervalued these stocks are—especially compared to their lows in the late '90s—our essay “How Cheap are Gold Stocks?” offers an in-depth look into our valuation methodology.

We remain exceedingly bullish on gold prices, confident that a major bull market is underway. Given the deeply undervalued status of gold equities, we believe they deserve your attention.

Join us for 2024 INVESTOR DAY on October 21. "Geopolitics, War, and Commodities". Both in-person and virtual options are available. To register or learn more: <https://conference.gorozen.com>

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