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“Crude Oil, Commodities, and Diversified Portfolios”

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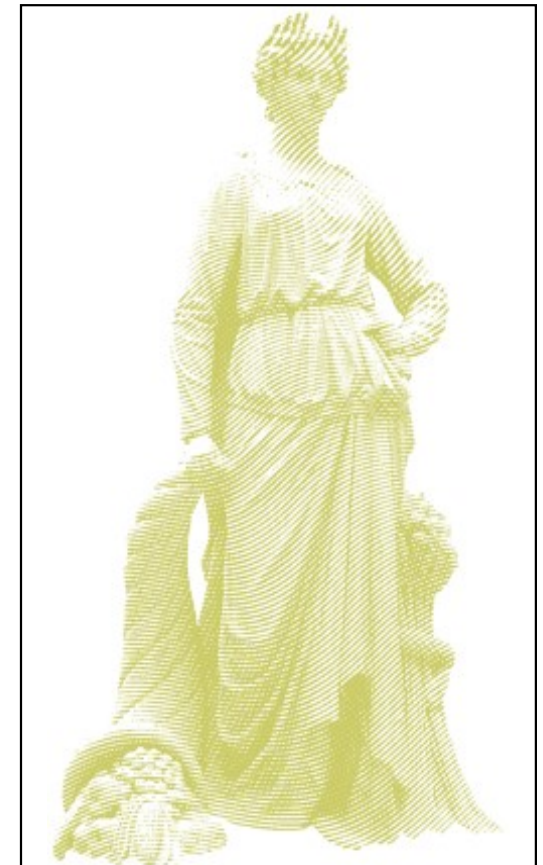
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Crude Oil, Commodities, and Diversified Portfolios

I. Literature Review

II. Dynamic Portfolio Construction

III. Conclusion



Icon above is based on the statue in the Chicago Board of Trade plaza.

Source: Updated from Till (2022).



I. Literature Review



A. Commodities for Inflation Hedging

B. The Special Role of Energy Futures Contracts

1. Diversification
2. Persistent Sources of Returns
3. A Timing Indicator for Crude Oil Futures

C. Sizing of Commodity Positions

D. Structural Breaks in the Oil Markets



A. Commodities for Inflation Hedging

Neville *et al.* (2021) find that “traded commodities have historically performed best during high and rising inflation.”

In addition, their dataset’s commodity baskets had “a perfect track record of generating positive real returns” across inflationary regimes in the U.S., “averaging an annualized +14% real return.”



B. The Special Role of Energy Futures Contracts

1. Diversification

Froot (1995) found that “almost any combination of commodities does at least reasonably well in protecting bond portfolios against inflation.”

“However, *oil* (with or without other energy prices) *is needed to effectively hedge stock portfolios.*”

Erb and Harvey (2006) provided further empirical evidence that is relevant to the portfolio diversification question.

These authors noted that “the non-energy sector has a statistically significant, but small equity risk premia beta.”



B. The Special Role of Energy Futures Contracts

1. Diversification

More recently, Bouchouev (2023) cites Bridgewater Associates’ “All Weather” strategy as looking at the returns on assets in terms of “two primary driving factors[:] growth and inflation.”

“The standard portfolio of stocks and bonds is only diversified with respect to the growth factor.”

And then to diversify “with respect to shifts in inflation expectations[,] ... oil ... must be added to the portfolio.”



B. The Special Role of Energy Futures Contracts

2. Persistent Sources of Return

Bouchouev and Zuo (2020) pointed out that energy futures contracts contribute a disproportionately large share of the “performance of many systematic commodity investments.”

And “[f]or many [published] strategies, the main contribution of most non-energy commodities was in adding diversification and improving the denominator of the portfolio Information Ratios.”



B. The Special Role of Energy Futures Contracts

3. A Timing Indicator for Crude Oil Futures

Tchilinguirian (2003) provided a conceptual explanation for why a futures curve would be backwardated during times of scarcity.

By having lower prices in further-delivery contracts relative to the spot month, the market provides no return for storing the commodity. Instead, during times of scarcity, the futures market incentivizes the delivery of the commodity for immediate use.

Therefore, a relatively simple indicator for scarcity is if the futures contract's front-month trades at a premium to the next delivery month's contract.



C. Sizing of Commodity Positions

Levine *et al.* (2016) examined what sizing would have been best historically.

In a 1946-to-2015 mean-variance optimization, the researchers found that the optimal portfolio would have been weighted 39% in bonds, 29% in commodities, and 31% in stocks.*

From these results, one would conclude that a commodity position as large as about 30% could be advisable, and we can check such a portfolio's results out-of-sample: that is, post-2015.

*** We assume that the weights do not add up to 100% due to rounding error.**



D. Structural Breaks in the Oil Markets

Bouchouev and Zuo (2020) warn that “[b]y and large, any systematic [oil] strategies based on data prior to 2016 must be taken with a great amount of skepticism.

While the shale revolution ... started gradually impacting the energy trading landscape much earlier, ... [a] structural break might have occurred around the end of 2015 when the ban on U.S. oil exports was eliminated.”

Bouchouev (2023) also notes that the “structural directional oil risk premium has vanished ... and [now] to capture ... [an oil risk premium], investment strategies must become dynamic as well.”



II. Dynamic Portfolio Construction



A. Trading Rules

B. Results

C. Impact of Publishing a Trading or Investment Strategy

D. Impact of a New Paradigm



A. Trading Rules

If the previous trading day's Brent front-month-to-back-month spread is trading at a premium, take positions amounting to 30% in U.S. equities, 30% in Brent contracts, and 40% in 10-Year Treasuries.

Otherwise, invest in the default portfolio of 60% U.S. equities and 40% 10-Year Treasuries.

We compare this trading rule's results to the following two portfolios: (1) a balanced 60% equity / 40% 10-Year Treasury portfolio, and (2) an unconditional allocation to 30% in equities, 30% in commodities, and 40% in 10-Year Treasuries.



B. Results

Summary Statistics

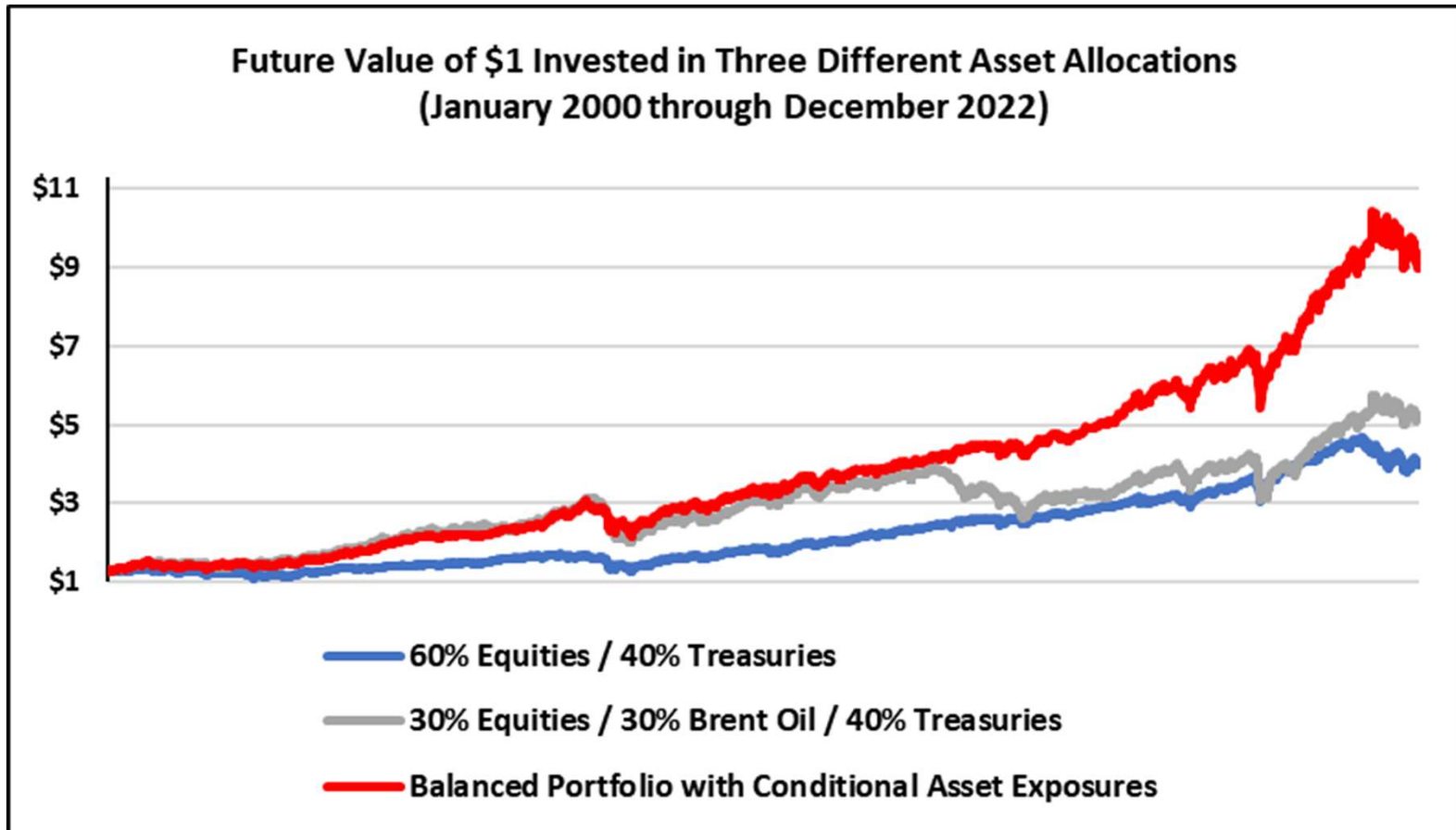
<u>Full Dataset: 2000 to 2022</u>	<u>60% Equities / 40% Treasuries</u>	<u>30% Equities / 30% Oil / 40% Treasuries</u>	<u>Dynamic Allocation</u>
Geometric Average Annual Return:	5.9%	7.2%	9.9%
Sharpe Ratio:	0.4	0.4	0.9
Worst Year:	-17.3%	-22.3%	-9.0%
<u>2000 to 2015</u>			
Geometric Average Annual Return:	5.3%	6.1%	9.3%
Sharpe Ratio:	0.3	0.3	0.8
Worst Year:	-17.3%	-22.3%	-9.0%
<u>2016-2022</u>			
Geometric Average Annual Return:	7.2%	9.6%	11.3%
Sharpe Ratio:	0.6	0.7	1.1
Worst Year:	-15.2%	-4.8%	-3.0%

Note: The Sharpe Ratios are calculated from yearly data.



B. Results

Growth of \$1 Invested in Three Different Asset Allocations



C. Impact of Publishing a Trading or Investment Strategy

One risk of publicly identifying investment or trading strategies that have historically had superior returns is that they will stop working as capital flows into them, a concern noted in Cochrane (1999).

But it may be that the particular dynamic asset allocation that is outlined in this presentation is sufficiently unusual as to prevent overcrowding in the strategy.



D. Impact of a New Paradigm

What will happen to the strategy outlined in this presentation if crude oil no longer remains a crucial fuel in the global economy?

Dale and Fattouh (2018) provide a framework for the prospect of “peak oil demand.”

Even if oil demand levels off, “[t]he world is likely to demand large quantities of oil for many decades to come.”

The key paradigm shift under a “peak oil demand” scenario is that there would be a break from “a past dominated by concerns about adequacy of supply.” *The world would be entering an “age of [oil] abundance.”*



D. Impact of a New Paradigm

The utility of our dynamic allocation's strategy signal is that it is a proxy measure of oil inventory scarcity.

And when there is a signal of surplus, the dynamic strategy does not include oil futures within its asset allocation.

Under a new paradigm of oil abundance, the strategy would be expected to default to the classic balanced portfolio of equities and Treasuries.



III. Conclusion



Based on insights in prior research, this paper suggests a dynamic asset allocation into crude oil when there is a (historically) reliable signal of scarcity.

Such a portfolio, which consists entirely of futures contracts, would have had a Sharpe Ratio of 0.9 from 2000-to-2022.

In addition, it would have had a Sharpe Ratio of 1.1 from 2016-to-2022.

A key concern with such a strategy is if the demand for crude oil is supplanted by alternative fuels.



III. Conclusion

Because the strategy is relying on the markets to provide a signal of oil scarcity or surplus, an investor can potentially be agnostic on when an energy transition could occur.

When a surplus in oil is signaled, the rules-based investment strategy defaults to a classic balanced portfolio.

As always, one must sound a cautionary note on the paper's historical results since past performance is no guarantee of future results.



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