
Commodity Investing: A New Take on Equities Versus Futures

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After the challenges in commodity markets in recent years, many investors are looking to bring their exposures back in line with their longer-term allocation targets. As a result, they are revisiting the issue of whether it is better to invest in commodities directly through commodity futures or indirectly through exposure to natural resource equities (NREs).

An argument is often made that investing in NREs results in better performance, in large part because investors avoid the potential headwinds of roll yield. Commodity futures investors are exposed to roll yield when they sell a contract before delivery and “roll into” a more distant contract. Roll yield can be positive (with downward sloping futures curves) or negative (with upward sloping futures curves). While it’s true that NREs are not directly impacted by roll yield, they carry their own risks, namely equity beta and higher volatility, for which investors should be compensated.

To investigate further, we created a framework for comparing the performance of NREs and commodity futures on an apples-to-apples basis. We found that two main factors contribute to NRE portfolio returns: a broad equity market factor and a commodity factor. Assuming that the market is efficient, we reasoned that an NRE portfolio would neither underperform nor outperform a portfolio that matches the same risk factors by taking exposure to a mix of broad equities and commodity futures.

Our key findings include:

- NRE exposure can be replicated by partial investments in the broad stock market and in commodity futures.
- On average, an investment of \$0.90 in the S&P 500 and \$0.41 in commodity futures tracked a \$1.00 investment in broad NREs with a high correlation of 0.8.
- Overall, the replicating portfolio modestly outperformed broad NREs in absolute terms, and because of its lower volatility, it also generated significantly higher Sharpe ratios.

- When extending the analysis to specific sectors (i.e., oil companies or mining companies), the replicating portfolios did not always outperform. For example, an oil industry equity portfolio was able to generate higher absolute (and comparable risk-adjusted) returns over time relative to a replicating investment in the S&P 500 and oil futures.
- The worst performing NRE sector relative to its replicating portfolio was gold.

The implications of these findings are very relevant for investors today: More often than not, it seems there is better return per unit of risk when investing in a combination of commodity futures and broad stocks than in natural resource equities.

ANALYZING AND COMPARING RETURNS

Our analysis focused on broad NREs as well as five individual NRE sectors (see Figure 1).

To construct a replicating portfolio for each NRE sector, we used regression models to find the combination of S&P 500 and commodity futures investment weights (also called betas) that most closely represented the returns posted by a basket of NREs. To capture changes in the relationship over time, a monthly rolling regression was estimated using a 10-year window. For each month, a replicating portfolio was then created with the corresponding betas in the S&P 500 and

Figure 1: NRE sectors and corresponding underlying commodities¹

| NRE sector | Commodity beta | Data since |
|-------------|----------------------|------------|
| Broad NRE | Broad Commodities | 1970 |
| Oil | S&P GSCI Petroleum | 1983 |
| Agriculture | S&P GSCI Agriculture | 1970 |
| Mining | S&P GSCI Base Metals | 1977 |
| Gold | S&P GSCI Gold | 1978 |
| Steel | S&P GSCI Base Metals | 1977 |

Source: Bloomberg, Kenneth R. French data library and PIMCO, as of 24 May 2016

commodity futures as well as a cash component in case the two factor betas didn't sum to 100% (they typically didn't). For example, if the commodity beta was 0.4 and the equity beta was 0.8, then the allocation to cash would be -0.2 to bring the total exposure in percent market value terms to 100%. This approach essentially eliminated in-sample bias as the replicating portfolio was generated using past data only. (The appendix contains a comprehensive description of the methodology.)

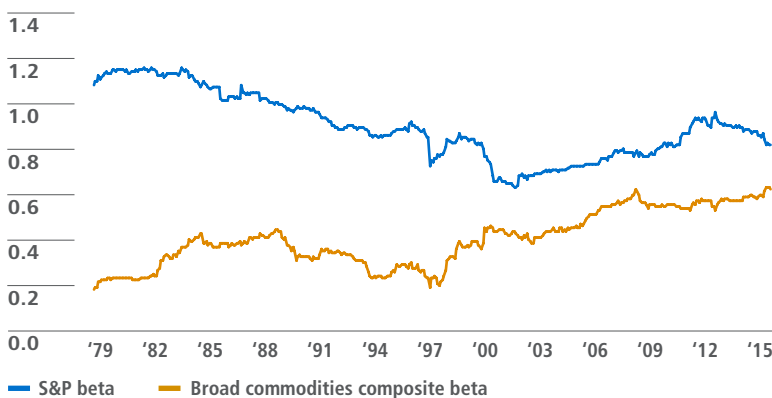
Figure 2 illustrates the evolving nature of factor betas. For broad NREs, the S&P 500 beta ranged from about 0.6 to 1.1 while the commodity beta generally increased over time from a low beta of 0.2 to a recent beta of 0.6.

Figure 3 displays the average regression results for broad NREs and select NRE sectors over the fully available time periods.

In general, most NRE sectors showed a higher beta to equity markets than to their respective commodity markets. The exception

Figure 2: Broad NRE sensitivities to equities and commodities trended over time

Replicating broad NRE: rolling betas using 120 monthly observations



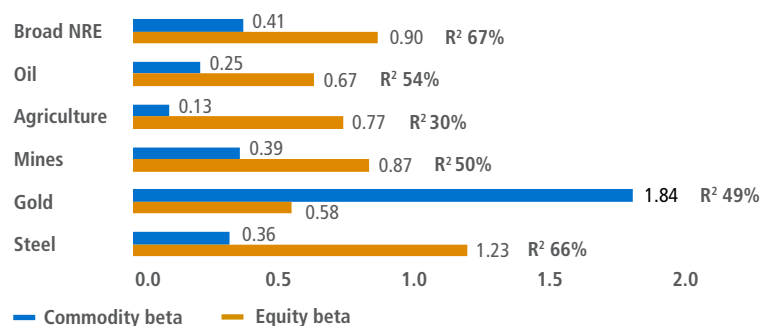
Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

was gold, which demonstrated a high commodity beta and the lowest beta to the equity market. All replicating portfolios outside of agriculture observed high R^2 and explanatory power. The appendix provides summary statistics on the regressions (Figure 9).

REAL IMPLICATIONS ARE RISKS AND RETURNS

While it is academically informative to expose the underlying economics of NREs, namely the extent to which they are influenced by the equity risk premium and their underlying commodities, the real implications for investors are risk and return characteristics. Figure 4 offers summary returns and volatilities for each sector with the maximum time periods available.

Figure 3: NREs observed significant loadings to both stock and commodity factors



Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

The top half of Figure 4 shows the performance of NREs. The bottom half displays the performance of the replicating portfolio. The replicating portfolio was a blend of S&P 500 equity exposure and commodity sector exposure based upon the trailing 10-year beta, as previously described.

The replicating portfolio outperformed NREs in absolute terms in four of the six examples. Further, in all six cases the replicating portfolio yielded higher risk-adjusted returns.

Figure 4: Summary returns, volatilities and Sharpe ratios

| Performance analysis | | Broad NRE | Oil | Agriculture | Mines | Gold | Steel |
|-----------------------|--------------|--------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| Time period | | 12/1979 12/2015 | 1/1993 12/2015 | 12/1979 12/2015 | 1/1987 12/2015 | 1/1988 12/2015 | 1/1987 12/2015 |
| Resource Equity | Performance | 8.7% | 9.7% | 11.1% | 9.0% | -1.9% | 4.6% |
| | Volatility | 20.4% | 19.2% | 21.8% | 27.6% | 37.4% | 28.3% |
| | Sharpe ratio | 0.19 | 0.37 | 0.29 | 0.20 | -0.14 | 0.04 |
| Replicating Portfolio | Performance | 11.1% | 7.8% | 10.4% | 11.8% | 7.9% | 13.4% |
| | Volatility | 17.0% | 13.6% | 13.0% | 18.5% | 29.4% | 23.5% |
| | Sharpe ratio | 0.37 | 0.38 | 0.44 | 0.45 | 0.15 | 0.42 |

Green: Higher performance. Red: Lower performance. Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

"More often than not, it seems there is better return per unit of risk when investing in a combination of commodity futures and broad stocks than in natural resource equities."

Figure 5: Common time period (1993–2015) confirms superior risk-adjusted returns for replicating portfolios

| Performance analysis | | Broad NRE | Oil | Agriculture | Mines | Gold | Steel |
|-----------------------|--------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Time period | | 1/1993 12/2015 | 1/1993 12/2015 | 1/1993 12/2015 | 1/1993 12/2015 | 1/1993 12/2015 | 1/1993 12/2015 |
| Resource equity | Performance | 8.2% | 9.7% | 10.7% | 7.3% | -1.4% | 2.7% |
| | Volatility | 20.8% | 19.2% | 21.9% | 28.5% | 39.5% | 29.4% |
| | Sharpe ratio | 0.27 | 0.37 | 0.36 | 0.16 | -0.10 | 0.00 |
| Replicating portfolio | Performance | 7.9% | 7.8% | 8.0% | 9.2% | 10.3% | 11.4% |
| | Volatility | 16.6% | 13.6% | 10.9% | 18.3% | 31.6% | 24.7% |
| | Sharpe ratio | 0.32 | 0.38 | 0.49 | 0.35 | 0.24 | 0.35 |

Green: Higher performance. Red: Lower performance. Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

Figure 5 presents the same data from 1993–2015 as this period is available for all sectors. Notably, the results didn't seem materially influenced by aligning time periods. While the absolute return levels changed, the relative conclusions remained largely intact. The replicating portfolios outperformed in absolute terms in three out of the six sectors, and all six performed better in risk-adjusted terms.

Given the consistently lower Sharpe ratio of NREs, it seems investors in NREs take more risk than they are compensated for. One explanation could be that some investors face constraints in accessing commodities directly and are willing to accept a lower return in NREs for their commodity-related, inflation-hedging properties. But for investors without asset class constraints, a replicating portfolio seems the preferred choice.

PREFERRED CHOICE IF NOT ASSET CLASS CONSTRAINED

Another consideration in favor of NREs is their intrinsically levered nature. The replicating portfolios, with the exception of the oil and

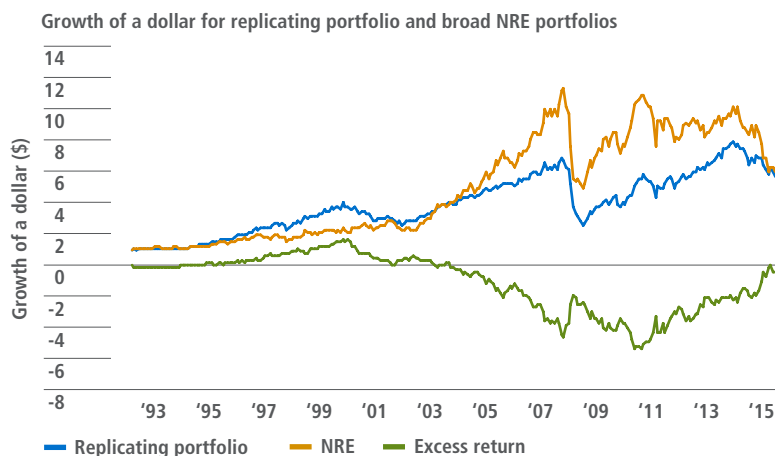
agriculture sectors, observed factor betas that sum to more than 100%. In other words, to build the replicating portfolio requires leverage, which for some investors can be a challenge and might be a partial cause of the relative underperformance of NREs.

It is important to note that relative NRE underperformance was not continuous, but rather cyclical. Figure 6 reveals the cumulative return dispersion between broad

NREs and the replicating portfolios. The excess return (green line) in Figure 6 shows the return of the replicating portfolio minus the return of NREs.

Prolonged periods of out-performance and under-performance were the norm over this period. This raised the question of whether certain factors can help explain and possibly predict relative performance.

Figure 6: Overall similar cumulative returns mask prolonged periods of dispersion



Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

Figure 7: Rolling relative performance highlights periods of sustained outperformance and underperformance

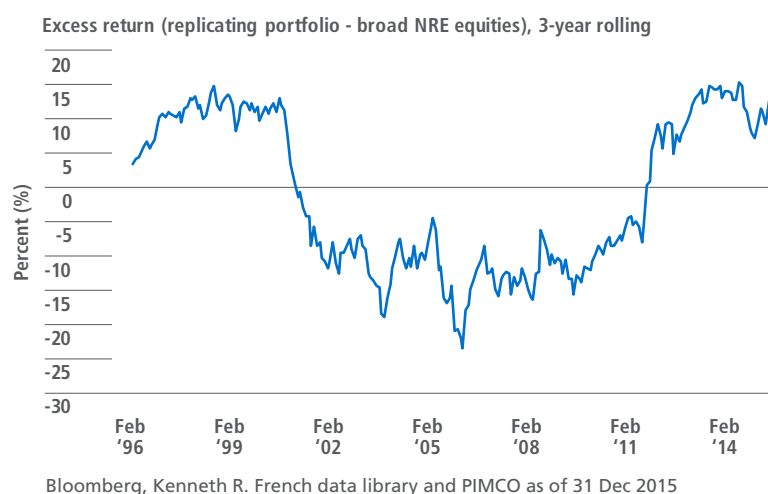


Figure 7 highlights this point by focusing on three-year rolling excess returns. NREs consistently outperformed during the “Goldilocks” period from the bursting of the tech bubble in the early 2000s through the global financial crisis (GFC), while the replicating portfolio consistently dominated before and afterwards.

To home in on the cyclical aspects, Figure 8 shows the performance statistics for the oil and mining NRE sectors and their replicating

portfolios both before and after the financial crisis. When focusing on risk-adjusted returns, we saw a similar picture: the Goldilocks period led to stellar NRE performance while the replicating portfolio outperformed after the global financial crisis. Over the whole period, oil stocks out-performed and mining stocks underperformed on a risk-adjusted basis.

One potential explanation could be the cyclical return behavior of energy and mining companies. Most commodity-producing projects are long-term investments with high upfront/fixed costs and relatively low marginal costs of production. During commodity boom cycles, elevated expectations for future commodity prices increase the attractiveness, or net present value (NPV), of new projects. This was especially the case during the period of “peak oil” concerns in 2007-2009 when the back end of the oil futures curve appreciated significantly, and elevated long-term price expectations might have influenced project valuations. Whether or not these projects deliver on this NPV depends on the future path of commodity prices in the years following project completion. Since many NRE companies tend to invest in high NPV projects at the same time, this can lead to an oversupplied market and negatively affect commodity prices.

Figure 8: Years leading up to the financial crisis benefited NREs

| Full period pre-GFC post-GFC | | Oil sector | | | Mining sector | | |
|------------------------------|--------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | Full period | Pre-GFC | Post-GFC | Full period | Pre-GFC | Post-GFC |
| Time period | | 1/2003 12/2015 | 1/2003 12/2007 | 1/2009 12/2015 | 1/2003 12/2015 | 1/2003 12/2007 | 1/2009 12/2015 |
| Resource equity | Performance | 9.5% | 30.2% | 4.6% | 11.4% | 48.0% | 6.2% |
| | Volatility | 20.5% | 17.8% | 19.9% | 32.9% | 25.2% | 32.4% |
| | Sharpe ratio | 0.40 | 1.53 | 0.23 | 0.31 | 1.78 | 0.19 |
| Replicating portfolio | Performance | 4.8% | 14.1% | 7.7% | 10.0% | 23.8% | 16.2% |
| | Volatility | 14.2% | 7.2% | 14.9% | 21.4% | 13.2% | 22.4% |
| | Sharpe ratio | 0.24 | 1.52 | 0.51 | 0.40 | 1.56 | 0.72 |

Green: Higher performance. Red: Lower performance. Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

COMMODITY SUPER CYCLE HITS NRES MORE

In the case of the recent commodity price decline, we can clearly see that equity value was destroyed as substantial capacity was added in the years just preceding the commodity price collapse in late 2014. This phenomenon is often referred to as the commodity super cycle, and our analysis suggests that NREs are affected more by the super cycle than replicating portfolios that invest directly in a mix of broad equities and commodity futures.

SUMMARY

When comparing performance between NREs and commodity futures, it is important to account for the equity beta present in NREs to make an apples-to-apples comparison, especially since the beta of NREs to broad equities is often higher than it is to the commodity market. While some investors may be accustomed to taking commodity exposure through natural resource equities, our study suggests that beta-replicating portfolios allocating directly to broad equities and commodity futures have historically provided superior risk-adjusted returns. It also shows that periods of outperformance and underperformance can be prolonged and are likely due to the long investment cycles in NREs. Going forward, if history is a guide (which it may or may not be), we should look for similar absolute and better risk-adjusted returns from a basket of commodity futures and broad equities compared to investments in NREs.

Figure 9: With the exception of the agriculture sector, all replicating portfolios observe high correlations and explanatory power

| | Broad NRE | Oil | Agriculture | Mines | Gold | Steel |
|----------------------|--------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| Time period | 12/1979 12/2015 | 1/1993 12/2015 | 12/1979 12/2015 | 1/1987 12/2015 | 1/1988 12/2015 | 1/1987 12/2015 |
| Commodity beta | 0.41 | 0.25 | 0.13 | 0.39 | 1.84 | 0.36 |
| Equity beta | 0.90 | 0.67 | 0.77 | 0.87 | 0.58 | 1.23 |
| Model R ² | 67% | 54% | 30% | 50% | 49% | 66% |
| Model standard error | 3.4% | 3.8% | 5.3% | 5.7% | 7.8% | 4.8% |
| Model correlation | 0.8 | 0.7% | 0.5 | 0.7 | 0.7 | 0.8 |

Source: Bloomberg, Kenneth R. French data library and PIMCO as of 31 Dec 2015

PIMCO's Tapio Pekkala, a senior vice president, contributed to this article.

APPENDIX – METHODOLOGY

NREs and commodities lend themselves to a beta replication analysis as both asset classes have been around for many decades, thus allowing observation of behavior during various economic regimes. Going back as far as 1970, our analysis covers almost five decades of financial returns.

To prevent over-fitting and in-sample biases, all of our results were out of sample: Using monthly return data, we estimated the long-run betas of NREs to both commodity markets and broad equities over a 10-year window. While providing a reasonable sample size of 120 observations,

this monthly rolling 10-year beta also allowed us to capture structural changes in sensitivities over time.

Using these betas, we then created a replicating portfolio consisting of X% of stocks, Y% of commodities, and 1-(X+Y)% of cash where X and Y represented the beta of NREs to stocks and commodities, respectively, and the cash allocation represented required leverage. We then held this portfolio for one month at the end of which we reconstituted the replicating portfolio based on the updated betas. As a result, the replicating portfolio returns were based solely on historical information that was available at the time of investment (i.e., out-of-sample portfolio).

¹ Broad natural resource equities were represented by an equally weighted total return index of seven sector total return indexes (agriculture, oil, mines, gold, building materials, steel and coal). Companies were included in the respective sector indexes using their Standard Industrial Classification (SIC) codes. Return series for equity price data and natural resource equities were obtained from the Kenneth R. French data library.

Broad equities are represented by the S&P 500 Total Return Index.

The Broad commodities composite was based on monthly returns from 1970–2015. It represented a fully collateralized total return index, whose methodology was based on Ibbotson's Strategic Asset Allocation and Commodities (2006). The index model was an equally weighted, monthly rebalanced composite of the following six commodity indexes: S&P Goldman Sachs Commodity Index Total Return (since 1970), Dow Jones-UBS Commodity Index Total Return (since 1991), Reuters/Jefferies CRB Total Return Index (since 1994), Gorton and Rouwenhorst Commodity Total Return Index (1959-2007), JPMorgan Commodity Futures Index (1970-2001) and Credit Suisse Commodity Benchmark Total Return Index (since 2001). It is not possible to invest directly in an unmanaged index. Nothing contained herein is indicative of the past or future performance of any PIMCO product.

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