



EXECUTIVE SUMMARY

Meketa Investment Group advises investors to hold public natural resource equities (NREs) as a portion of their inflation-hedging assets. This is because diversified institutional portfolios should devote some assets to protecting against unexpected inflation, and public NREs are one of several asset classes whose value holds steady or appreciates during periods of unexpected inflation. However, unlike other inflation-hedging assets, public NREs have long-term returns closer to those of broad equities; thus, holding them presents less of an opportunity cost. At the same time, public NREs have historically been volatile, which presents behavioral finance challenges, but also rebalancing opportunities for disciplined investors.

This report includes two main parts: a high-level review of inflation and how one can hedge against it, and a discussion of the efficacy of public NREs as inflation hedges. We also provide an assessment of the current environment in Appendix A.

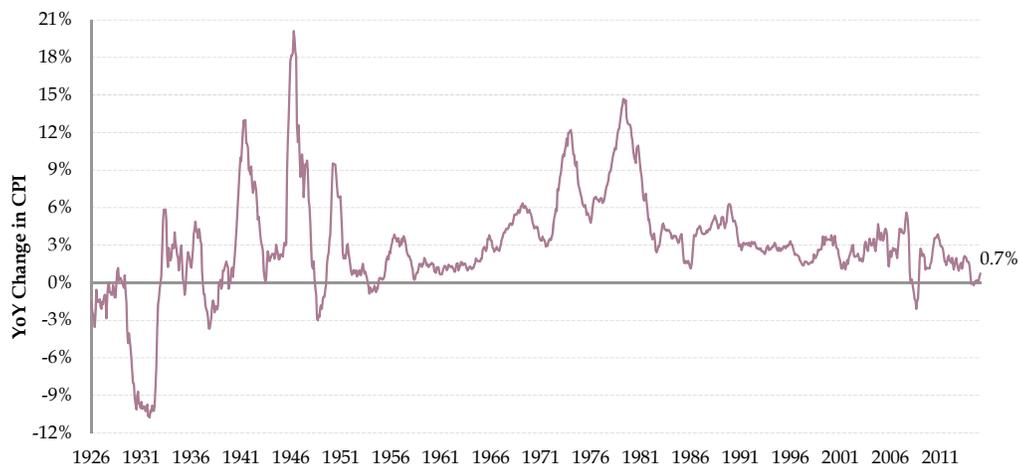
INFLATION AND INFLATION HEDGING

Inflation: What it is and How it is Measured

Inflation is the increase in the price level of goods, services, and assets in an economy over time. When the price level rises, each unit of currency buys fewer goods, services, and assets; thus, it is a reduction in the purchasing power of money. If the quantity of dollars in a pool is unchanged from some prior point in time, but can buy less now than previously, its *nominal* value remains the same, but its *real* (purchasing power) value has declined.

U.S. Inflation is commonly measured as changes in the weighted average price of a “basket” of consumer goods and services, called the Consumer Price Index (CPI), the historical trajectory of which is shown below.

Chart 1. U.S. Inflation



Why Inflation Occurs

Inflation is a complex phenomenon and is viewed as having several supply and demand drivers. It may be caused by any or all of the following:

- Increases in the money and credit supply in excess of an increase in sustainable economic activity. This is often caused by governments printing additional money (“too many dollars chasing too few goods”).¹
- Increases in aggregate demand for goods and services, which may be due to higher levels of consumer, business, and government spending.
- Decreases in aggregate supply of goods and services, typically resulting from crisis shocks (war, disasters, transport disruptions, embargoes, cartel production limits).

The widespread adoption of fiat currency (i.e., paper money) not backed by the value of other assets has given national governments increased, but still imperfect, control of the money supply. In the past century, governments have typically tried to achieve positive, low, and steady levels of inflation, but circumstances do not always permit this to happen.

Inflation’s Impact on Traditional Portfolios

“Traditional” or “blended” portfolios primarily consist of equities and fixed income. Historically, both of these have lost real value during periods of inflation—specifically, unexpected inflation.

Equities are ownership shares in corporations. Their fundamental value is based on a discounted stream of future cash flows, comprising a potentially unending series of dividend payments, the value of which fluctuates depending on the economic fortunes of the corporations. *In the short term*, inflation often pushes up a firm’s nominal costs faster than its nominal revenues, which reduces nominal earnings and can cause a firm to decrease its nominal dividend payment. Even if the nominal dollar value of the dividend payments does not change, inflation causes their real dollar value to decline, reducing the real value of equities. Yet *in the long term*, as corporations adjust operations to the new price environment, their internal economics often result in increased earnings and dividends in nominal and (in some cases) real terms, *potentially* enabling equities to recover their real value.

Fixed income securities are loans to governments, corporations, or other entities. Their fundamental value is based on a discounted stream of future cash flows, comprising a finite number of interest payments plus a final repayment of principal. While the nominal dollar value of the interest and principal does not change, inflation causes their real dollar value to decline, reducing the real value of fixed income securities. Unlike equities, fixed income securities typically do not eventually recover their real value following a period of inflation.

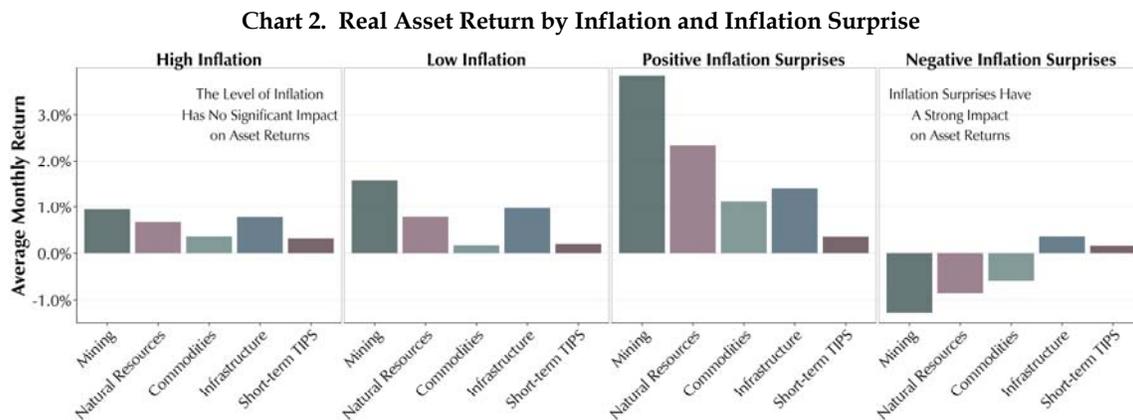
¹ In pre-modern times it was also caused by new influxes of whatever was used as money, e.g. increases in the gold and silver supply after the discovery of the New World.

Unexpected versus Expected Inflation

Unexpected inflation has historically been much more damaging to the value of assets than expected inflation. *Expected* inflation is usually relatively benign for equities and fixed income. As discussed, inflation may erode the value of future income streams, but as long as this is expected, it will be “priced into” the fundamental valuation of equities and fixed income.

Unexpected inflation by definition cannot be “priced in”; it is a surprise increase² in price level, which leads to a surprise decrease in equity or fixed income valuation. Furthermore, unexpected inflation reduces future price certainty, which has a negative impact on businesses’ ability to develop long-term economic contracts. Markets react poorly to uncertainty.

The chart below illustrates the clear response from inflation-hedging “real assets” to inflation surprises (right two boxes), and the more muddled relationship between the absolute level of inflation and those assets’ price levels (left two boxes).



Potential Inflation-Hedging Assets

It is straightforward to describe inflation hedges in theory, but observing them in practice is harder. We consider financial instruments to be inflation hedges if they react positively when consumer price levels increase.

The historical track record against which to test the robustness of assets’ inflation sensitivity is limited. Individual countries have often experienced localized periods of inflation, but as shown below there have only been two major periods of global inflation in the past 75 years, both of which were unexpected: World War II & the immediate postwar period (1941–48), and the Great Inflation of the 1970s (1968–82).

² Negative unexpected inflation (a.k.a. unexpected deflation), namely a surprise decrease in the price level, could occur, but this is uncommon.

Table 1. Major Periods of Global Inflation Since 1940

	Duration	Average YoY Inflation Rate (%)	Maximum YoY Inflation Rate (%)	Cumulative Loss of \$ Purchasing Power (%)
World War II/Early Postwar	7.4 years	7.5	20.1	-42
Great Inflation	14.2 years	7.6	14.7	-66

The Purpose of a Dedicated Inflation-Hedging Allocation

Holding assets that do not decline in real value during unexpected inflationary periods enhances the ability of the total portfolio to make payouts while protecting its value on the downside. As such, inflation hedges are a useful complement to an equity-dominated portfolio. The main driver of portfolio growth remains the allocation to equities, which are expected to have the highest returns over the long term.

Inflation hedging assets are expected to maintain or increase their real value during periods of unexpected inflation, during which time most equities and fixed income are declining in real value.³ This diversification reduces the volatility of the total portfolio's value, even though the inflation-hedging assets may demonstrate considerable volatility taken in isolation. Inflation hedges may also be tapped for payouts during this period, leaving other assets with unrealized losses untouched, and giving them time to recover their real value. At the same time, however, investors must recognize that the benefits provided by such hedges may be offset by the opportunity cost of holding a portion of assets in something other than equities.

Examples of Inflation-Hedging Assets

Several asset classes provide some level of protection against inflation due to their economic drivers of return. Below we describe four such in brief, before going more in-depth about public NREs.

Private Real Assets include commodities (see below), land, infrastructure, and developed real estate. These are supply-constrained and have an intrinsic level of real value that remains relatively stable in periods of inflation. Note that private real asset investments are typically structured as *illiquid* partnerships, akin to private equity investments; while they may contribute solidly to returns, they cannot be relied upon to fund payouts when needed.

Treasury Inflation-Protected Securities (TIPS), also known as Inflation-Linked Bonds (ILBs) or "linkers, are government-issued fixed income securities for which the principal's nominal value is periodically adjusted by the inflation rate, preserving the principal's real value. The interest payments are calculated as a

³ This is analogous to the purpose of the deflation hedge (the allocation to fixed income), which is expected to maintain or increase its nominal value during deflationary and/or recessionary macroeconomic periods when equities are declining in nominal value: it reduces the volatility of the total portfolio's value and may be tapped for payouts during this period, giving other assets with unrealized losses time to recover their nominal value.

percentage of this nominally-adjusted principal, thus their real value is likewise preserved.

Real Estate Investment Trusts (REITs) are equity shares in firms that own and operate income-producing real estate. During inflationary periods, the underlying real estate's (real) value remains stable, while the rent-derived income typically resets periodically to reflect the new prevailing price level, and thus also remains stable in real terms.

Commodities is a term comprising a broad array of raw materials. These are the actual, supply-constrained production inputs, such as energy (e.g., oil, natural gas), metals (copper, gold), and agricultural (corn, cattle). Investors should be aware that, because delivery and storage of the physical commodity poses challenges, economic exposure is usually achieved through *commodities futures contracts*.

PUBLIC NATURAL RESOURCE EQUITIES AS INFLATION HEDGES

Definition, Returns, and Inflation Hedging

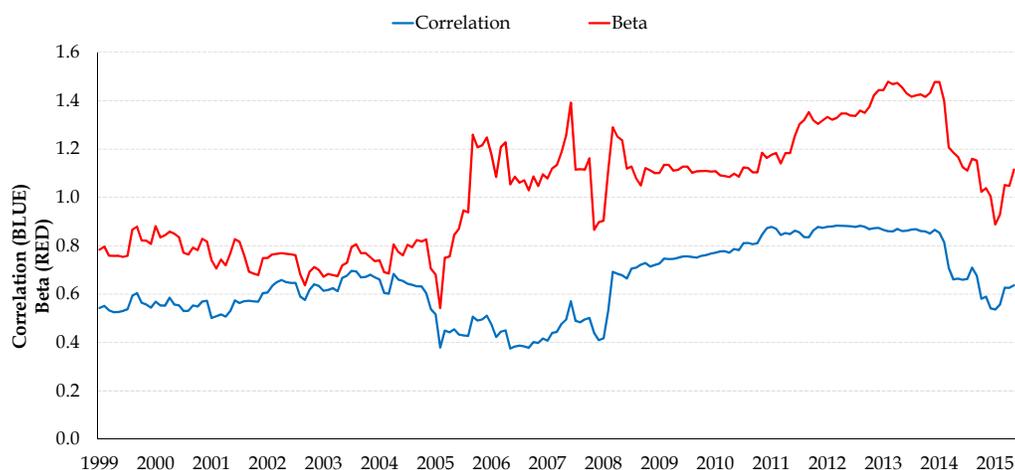
Public natural resource equities (NREs) are equity shares in firms that extract and process natural resource raw materials (i.e., commodities). Thus, their economic exposure is a hybrid of inflation hedging and the returns generated by the broad equity market, also known as equity "beta."

On the one hand, these firms' revenues are derived from products for which the real value should remain stable even in an inflationary environment (i.e., their nominal price level should increase). Even if nominal costs also rise due to inflation, earnings and dividends should increase nominally and at least stay stable in real terms.

On the other hand, these are equity shares, and their values may fluctuate akin to other equities and not only because of changes in fundamentals, but also due to investor sentiment. As shown in the following chart, the correlation of public NREs to "broad" equities has risen since the Global Financial Crisis and averages > 0.6 , while their beta had been less than that of "broad" equities but has been greater than 1.0 in the last decade.⁴

⁴ This is to say that, given a certain amount of change in the value of broad equities, NREs' value used to change less, but now change more than that of broad equities. It is uncertain what is driving this increase in beta and whether it will prove to be ephemeral or lasting.

**Chart 3. Natural Resource Equities
S&P North American NRE Index
Trailing 36-Month Metrics vs. S&P 500**



Thus, at times, public NREs' inflation and equity exposures may "pull" the investment's value/returns in different directions, which could be an advantage or a drawback. If NRE's equity exposure delivers a higher long-term return than other inflation-hedging assets, it reduces the opportunity cost of holding NREs (in lieu of broad equity). However, if NRE's inflation sensitivity is diluted compared to that of other inflation-hedging assets, it reduces the hedging benefit of holding NREs (relative to other inflation-hedging assets).

We found that the long-term performance⁵ of NREs has been close to broad equities (S&P 500) as well as TIPS, has lagged REITs, and has beaten commodities (GSCI index), CPI, and cash (T-bills), but volatility has been high. At the same time, long-term inflation beta has been second only to that of commodities, and has been consistently positive and greater than one in all standard trailing periods. We infer from the available evidence that NREs offer positive inflation sensitivity without sacrificing long-term returns.

Table 2. Historical Returns, Volatilities, and Inflation Betas of Various Assets (through 12/31/2015)

Period	Metric	S&P NA NRE	Barclays U.S. TIPS	MSCI U.S. REITs	S&P GSCI	S&P 500	CPI	3mo T-bills
1-year	AACR	-24.3%	-1.4%	2.5%	-32.9%	1.4%	0.7%	0.0%
3-year	AACR	-7.3%	-2.3%	11.1%	-23.7%	15.1%	1.0%	0.0%
5-year	AACR	-5.5%	2.5%	11.9%	-15.2%	12.6%	1.5%	0.1%
10-year	AACR	1.5%	3.9%	7.0%	-10.6%	7.3%	1.9%	1.2%
Since 3/31/1998	AACR	5.2%	5.8%	9.2%	-1.4%	5.8%	2.1%	2.1%
Since 3/31/1998	StDev	23.1%	5.9%	21.6%	23.5%	15.4%	1.3%	0.6%

Period	Metric	S&P NA NRE	TIPS	REIT	GSCI	S&P 500	CPI	T-bills
1-year	Beta to CPI	4.7	(1.7)	(5.3)	8.4	3.2	1.0	(0.0)
3-year	Beta to CPI	4.4	(0.4)	(2.4)	8.0	0.6	1.0	0.0
5-year	Beta to CPI	2.8	(0.1)	(1.3)	5.8	0.7	1.0	0.0
10-year	Beta to CPI	3.3	0.3	1.3	7.2	1.2	1.0	0.0
Since 3/31/1998	Beta to CPI	2.6	0.4	0.9	6.2	0.4	1.0	0.1

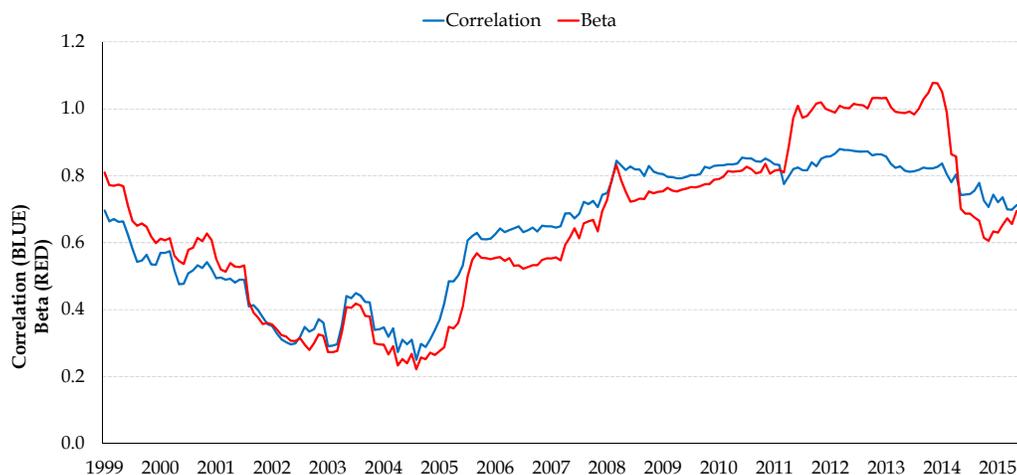
⁵ Since 3/31/1998: longest common period for all asset classes' index returns. A longer period that permitted segmentation into several multi-decade return streams would be preferable as it would mitigate endpoint bias and provide insight into different market cycles and economic regimes, resulting in more robust conclusions. Please see Appendix B for a brief discussion of endpoint bias.

Additional Characteristics of Natural Resource Equities

NREs are also considered by some to be a levered play on commodity prices, using the rationale that, because of high fixed costs associated with commodity production (which creates operating leverage), cyclical fluctuations in prices and revenues should cause even larger swings in earnings and share prices. If this logic is correct, NREs should tend to be even more volatile than their underlying commodities.

However, while NREs are surely subject to booms and busts, evidence suggests a muted rather than levered exposure.⁶ Their correlation to the S&P GSCI index has risen in the last decade and has averaged ~0.65, and with brief exceptions, beta to the GSCI has remained under 1.0 and has also averaged ~0.65.

**Chart 4. Natural Resource Equities
S&P North American NRE Index
Trailing 36-Month Metrics vs. S&P GSCI**



Investors should be mindful that NREs are a multi-component category that combines distinct and investable sub-sectors,⁷ including energy, industrial metals and mining, precious metals and mining, agribusiness, forestry and timber, and other materials. NREs also constitute a broad sector already held within a larger equity allocation, which presents the potential risks of doubling-up exposure and increasing total portfolio equity beta. Finally, NREs provide a proxy allocation where assets committed to private real assets, but not yet called, may be temporarily “parked” to achieve *roughly* similar exposure.

⁶ A number of major natural resource firms have integrated operations that include both extraction and processing. A price increase in raw materials helps earnings from extraction but hurts earnings from processing since the input cost has risen. This diversification creates some degree of self-hedging. Also, some producers do utilize direct hedging (via derivatives), although this varies depending on their underlying commodity, stage in the supply chain, and price level.

⁷ The proportions of each in a broadly-diversified NRE index will vary substantially based upon how the index is constructed, as detailed on the following page.

Table 3. Inflation-Hedging Sector Exposures of Major Broad Indices

As of 12/31/2015	Energy (%)	Materials (%)	All Other Sectors (%)
S&P 500	6.5	2.8	90.7
MSCI EAFE	4.5	6.4	89.1
MSCI EM	7.1	6.0	86.9

Implementation of Public Natural Resource Equities

In practice, investors in public NREs must consider (i) an appropriate benchmark, (ii) whether to use active or passive management, (iii) from what place to source an allocation, and (iv) how much to allocate.

The two main NRE benchmarks differ mainly by relative weights of the components as well as geography. The first, the S&P North American Natural Resource Equity index, represents U.S. and Canadian domiciled securities in the energy and materials sectors (e.g., steel and chemicals). It is 84% composed of energy firms, which in turn are heavily skewed toward “supermajor” integrated oil. The second, the S&P Global Natural Resource Equity index, includes 90 of the largest global publicly-traded companies in natural resources and commodities businesses. The group is deliberately divided into three equally-weighted composites – agriculture, energy, and metals & mining – which are allowed to diverge during the year, then rebalanced annually. In contrast with the North American index, the Global index geographically consists of only 33% U.S. and 10% Canada, with the rest of the world comprising the remainder.

There are a limited number of passive implementations that follow the broad natural resource equity benchmarks available, mostly via institutional commingled funds and separate accounts. For smaller mandates, the existing mutual funds and ETFs are typically narrower, tracking just energy or materials sector equities.

A small number of active strategies are available. These are characterized by fairly high tracking errors to the benchmarks (which are dominated by supermajor integrated oil firms) to allow the managers more opportunity to add alpha, usually by skewing toward smaller cap stocks, which tend to be more volatile. There is considerable sector concentration, including single-sector vehicles (e.g., all energy, all materials). Fees are in the 100 basis point range. Long-short funds also exist, with higher fees. While these offer opportunities to add distinct sources of alpha, inflation sensitivity is muted because net exposure is typically less than 100%.

Allocations to public NRE, sized at up to 5% of total assets, may be sourced from any of the following: a dedicated inflation-hedging or real assets portion of the portfolio; a specific natural resources portion of the portfolio (together with private natural resources); and long-only equities (since public NREs will also contribute equity beta).

CONCLUSION

Public NREs are a useful component of the long-term allocation policy for a well-diversified portfolio. Their real value has historically held steady or appreciated during inflationary periods better than most other asset classes. Additionally, compared with other inflation hedges, there is a lower opportunity cost to hold them, since their long-term returns are closer to those of broad equities. Still, investors must be prepared for a bumpy ride, as the asset class has been volatile historically.

APPENDIX A: THE CURRENT ENVIRONMENT

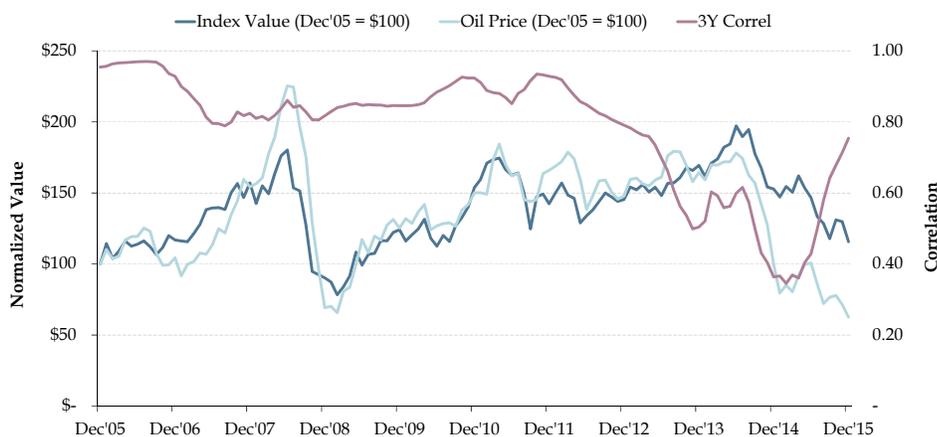
The above constitutes our permanent advice: long term, investors should utilize public NREs as a portion of their hedge against inflation. Given the current environment, despite attractive valuations, supply-demand considerations weigh against a near-term tactical overweight tilt. Specifically, at this time: for investors who do not hold NREs, we do not recommend incepting a position; and for investors who currently have NREs, and whose holdings' value has likely declined to the point where they are underweight versus the target, we recommend no change – neither reduce nor add to the position – since we do not see a catalyst to unlock public NREs' value in the immediate future.

At the present time the “elephant in the room” comprises two issues: the volatility of public NREs' returns and their recent weakness. Over a nearly 20-year period,⁸ public NREs have delivered fairly strong long-term average annualized performance at 6.3%, lagging somewhat behind broad equities (measured by the S&P 500) at 8.1%. Risk has not been in line with returns, however, as the *lower*-returning public NREs displayed *higher* volatility at 22.6% per annum, versus 15.5% for broad equities.

This volatility was particularly striking and damaging in the second half of 2014 and calendar year 2015. From its peak in June 2014, the S&P NA NRE index was down 41% through the end of 2015, which contrasts with the S&P 500 having gained 8% in the same period. The decline was largely due to the falling price of oil, to which NREs are highly exposed and correlated. (Please see Chart A-1.)

In the same 1½-year period, crude oil fell 65% due to macro supply- and demand-based drivers. *Supply* increased in the U.S. (as a consequence of the spread of fracking technology) and internationally (production in both Iraq and Libya was brought back on line), while Saudi Arabia opted not to cut production but instead sought to claim market share. On the other hand, slowing economic growth worldwide, especially in China, was lowering *demand*.

Chart A-1. S&P NA NRE Index Value vs. WTI Crude Oil Price, and 3Y Correlation



⁸ From September 1996, the inception of the S&P North American Natural Resource Equity (NA NRE) index, through December 2015.

This price decline was not limited to oil; following heightened investment in production, other commodities experienced oversupply and reduced demand as well. Consequently, NRE valuations appear attractive. (Please see Charts A-2 and A-3.)

Chart A-2. Relative PE10 for Energy Stocks vs. ACWI 2005 - 2015

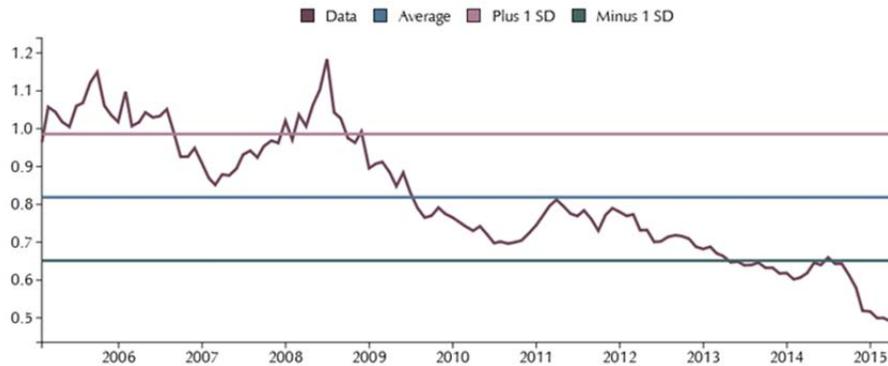


Chart A-3. Relative PE10 for Material Stocks vs. ACWI 2005 - 2015



Nevertheless, *we do not recommend adding to this asset class in the short term* because of oil-market-specific dynamics. First, the oversupply of oil is likely to continue, due to increased production from Saudi Arabia, the return of Iraq to full production, and the imminent return of Iranian production as sanctions are lifted. Second, even if OPEC were to agree on cutting production to drive up prices, above a certain threshold any mid-cost producers will re-enter the market, effectively creating a ceiling on the price of oil. Demand for oil will stay relatively weak during this global economic slowdown, and may face additional downward pressure from fossil fuel divestment and other actions to reduce greenhouse emissions. Many other commodities are also experiencing excess supply (after years of investments in production) coupled with lower global demand. Note that the cycle will eventually turn, as current cuts in investments for new production lead to tighter supply; thus, we do not recommend exiting the asset class.

APPENDIX B: RECOGNIZING AND ADJUSTING FOR ENDPOINT BIAS

In the main paper we analyzed the returns, volatility, and inflation betas of various assets, as represented by their respective indices, during the longest common period for which we have data. This period spanned nearly 18 years, from 3/31/1998 through 12/31/2015. The final 18 months of that period were particularly challenging for both NREs and commodities, as noted in Appendix A, and therefore metrics drawn from then may not be the most representative measures of the long-term behavior of those asset classes.

While our intent is not to cherry-pick the measurement periods to pre-dispose the results in favor of NREs, we re-ran the analysis for the 15+ year period ending 6/30/2014, which excludes the 18-month decline:

Table B-1. Historical Returns, Volatilities, and Inflation Betas of Various Assets (through 6/30/2014)

Period	Metric	S&P NA NRE	Barclays U.S. TIPS	MSCI U.S. REITs	S&P GSCI	S&P 500	CPI	3mo T-bills
Since 3/31/1998	AACR	9.2%	6.5%	9.2%	3.7%	5.8%	2.4%	2.3%
Since 3/31/1998	StDev	23.1%	6.0%	22.1%	23.1%	15.7%	1.3%	0.6%
Since 3/31/1998	Beta to CPI	2.1	0.4	1.3	5.4	0.3	1.0	0.0

When compared with Table 2 of the main paper, the notable results are that, since inception, the volatility and inflation beta metrics remain rather stable. We believe the appropriate conclusion to draw from the analyses of the two periods is that, over the long term, NREs do display higher volatility than broad equities as well as inflation beta that is positive and greater than one.

As for performance, one would expect to be compensated with a higher return for a more volatile asset. Compared with broad equities, that was not the case for NRE during the period ending 12/31/2015, but that included a particularly severe drawdown at the end. Yet NRE did deliver a much higher return than broad equities for the since-inception period ending 18 months earlier, which more than compensated for its higher volatility. The annualized compound returns swing considerably in favor of both NRE and commodities (gains of +4% and +5.1% per annum, respectively) when the most recent poor performance is excluded. We would venture that a better estimate of NRE's expected return may lie somewhere between the 5.2% per annum (through 12/31/2015) and the 9.2% per annum (through 6/30/2014) and is probably at least comparable to those of broad equities, i.e. the opportunity cost of holding NRE in lieu of broad equities is likely minimal.