Betting Against Oil: The Implications of Divesting from Fossil Fuel Stocks

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Abstract

We examine how divesting from fossil fuel stocks, as announced by several large institutional investors, affects the systematic risk exposures of an equity portfolio. We find that fossil fuel stocks exhibit a highly significant positive exposure towards changes in the oil price. Consistent with this result we observe that fossil fuel stocks outperform strongly during oil bull markets and underperform strongly during oil bear markets. For bull and bear scenarios concerning the energy sector itself we find even more pronounced results. Within the equity market the materials sector appears to offer the best hedge for fossil fuel stocks, but this sector also tends to have a high carbon footprint and environmental issues. Oil futures could be a direct hedge, but may be even less acceptable to investors who do not want fossil fuel exposure. Altogether we conclude that excluding fossil fuel stocks comes down to an active bet against the oil price, which makes a portfolio vulnerable to significant underperformance in the short and medium term.

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1. Introduction

Several large institutional investors have announced that they will sell off their holdings in fossil fuel stocks due to concerns about climate change. Examples include the ABP and PME pension funds in the Netherlands[1], which plan to divest fully from fossil fuel stocks, and three New York City pension funds, which announced a partial divestment.[2] Given the many 'net zero' commitments that have been made and continued pressure from environmental action groups, more investors are likely to follow.[3] Excluding stocks for non-financial reasons is known as socially responsible (or sustainable) investing, which started many years ago with the exclusion of classic 'sin stocks', such as the tobacco, alcohol, gambling, and weapons industries. More recently, sustainable investors broadened their scope to shunning stocks with poor Environmental, Governance, or Social (ESG) practices, and reducing the carbon footprint of their portfolios; see e.g. Boermans and Galema (2019) and Choi, Gao, Jiang, and Zhang (2021) on the latter. However, abandoning a best-in-class approach and instead divesting fully from the fossil fuel industry marks a new, more aggressive step.

The performance implications of excluding sin stocks and ESG investing have been extensively studied in the literature. The theoretical model of Pastor, Stambaugh, and Taylor (2021) predicts that if investors derive utility from holding sustainable assets and disutility from holding unsustainable assets, they should be rewarded with higher financial returns for holding the latter. On casual inspection this appears to hold empirically for traditional sin stocks, as it is well known that these have significantly outperformed the market historically. However, Blitz and Fabozzi (2017) find that the return of sin stocks can be fully explained by their exposures towards certain asset pricing factors, in particular the quality and low-risk factors. Thus, there appears to be no evidence for the existence of a distinct sin premium. Moreover, ESG investing is generally found to be beneficial instead of harmful for performance, according to the meta study of Friede, Busch, and Bassen (2015). However, Bruno, Esakia, and Goltz (2022) show that reported outperformances of ESG strategies also disappear after properly controlling for exposures to common asset pricing factors.

The impact of excluding fossil fuel stocks on long-term expected returns is less clear. Blitz and Swinkels (2021) find that fossil fuel stocks exhibit a large positive exposure towards the value factor, so naively excluding fossil fuel stocks can come down to shorting the value premium. Moreover, Bolton and Kacperczyk (2020) find that there is a return premium associated with the carbon emissions of firms, i.e. a carbon premium. On the

[1] ABP is the pension fund for civil servants and PME is the pension fund for the metal and technology industries in the Netherlands.

[2] https://www.pionline.com/pension-funds/3-nyc-pension-funds-divest-3-billion-fossil-fuels

[3] For instance, the Net Zero Asset Managers Initiative claims to have over 200 signatories with over $50 trillion in assets under management.

other hand, Sireklove (2016), Trinks, Scholtens, Mulder, and Dam (2018), and Plantinga and Scholtens (2021) find that divesting from fossil fuel stocks has not been harmful to average portfolio returns historically. Moreover, fossil fuel stocks may turn out to be stranded assets, if a large part of their fossil fuel reserves may never be extracted; see e.g. Caldecott (2017).

This article adds to the literature by examining the implications of divesting from fossil fuel stocks on the systematic risk exposures of an equity portfolio.[4] In other words, instead of looking at asset pricing factors which command a premium in the long run, we focus on macro-economic risk factors which explain large differences in short- and medium-term returns. We find that fossil fuel stocks have a highly significant positive exposure towards changes in the oil price. This means that if the oil price falls, fossil fuel stocks can be expected to underperform, while if the oil price rises they can be expected to outperform. Empirically we find that such oil bull or bear markets can last many years and that their impact on fossil fuel stock returns is sizable. Investors who exclude fossil fuel stocks are therefore effectively making an active bet against oil.

The best hedge in the stock market is to fill the gap that arises from excluding fossil fuel stocks with stocks from the basic materials sector, such as mining stocks. However, such stocks also tend to have a high carbon footprint, so using this hedge would seem to defeat the purpose of the fossil fuel divestment decision. The risk of betting against oil could also be mitigated by going long oil futures in the commodity derivatives markets, but that would probably be an even less acceptable solution if the objective is to abandon fossil fuels. We conclude that divesting from fossil fuel stocks comes down to an active systematic bet against the oil price that is probably hard to avoid, and which can cause significant underperformance in the short and medium term.

2. Data

Fossil fuel stock divestment tends to be focused on the oil and gas production companies such as ExxonMobil, British Petroleum (BP), and Royal Dutch Shell, that are found in the GICS energy sector. Firms that use fossil fuels, such as utilities and airlines, or firms which have high carbon emissions for other reasons, such as mining and cement stocks, generally appear to be out of scope. This is confirmed by looking at the holdings of the MSCI World ex Fossil Fuels and S&P 500 Fossil Free indices, which use ownership of fossil fuel reserves as the exclusion criterion. Although the number of excluded stocks is

[4] The question whether divestment from fossil fuel stocks is effective at reducing greenhouse gas emissions is beyond the scope of this study. Blitz and Swinkels (2020) discuss the pros and cons of exclusion, i.e. selling off ones holdings to other investors, versus an active ownership policy, i.e. voting at shareholder meetings and engagement aimed at changing corporate conduct.

limited, at about 70 (out of 1500 or so index constituents) for MSCI World and only 16 for the S&P 500, they are mainly concentrated in the energy sector. As a result, approximately three-quarters of the weight of the energy sector is eliminated in both indices.[5] In the remainder of this paper we will take the energy sector as a proxy for the stocks that are targeted with fossil fuel divestment.

We gather monthly total returns in US dollars for the MSCI World index and the 11 GICS level 1 sectors, including energy, from Refinitiv Datastream. The data is available from January 1995 to December 2021, so a period of slightly more than a quarter century. From the same source we obtain oil price data and the return on 5-year maturity benchmark bonds, using the codes CRUDOIL and BMUS05Y. These series allow us to examine exposures to two key non-equity systematic risk factors, namely the oil price and interest rate changes. Finally, we use the risk-free return on short-term US Treasury Bills (RF series) from the Kenneth French online data library.[6]

3. Systematic exposures of fossil fuel stocks

We regress the monthly returns of the individual sectors on the equity market return (MSCI World index), the bond return, and the percent change in the oil price. We use the full sample and take stock and bond returns in excess of the risk-free return[7], as in the following equation:

$$R_{sector} - R_{RF} = \alpha + \beta_{equity}\left(R_{equity} - R_{RF}\right) + \beta_{bond}(R_{bond} - R_{RF}) + \beta_{oil}R_{oil} + \varepsilon$$

Exhibit 1 reports the three estimated betas for each sector. We observe that the energy sector has an equity beta below 1, although not nearly as low as classic low-beta sectors such as utilities, consumer staples, and health care. The bond beta of the energy sector is slightly negative, but statistically insignificant (t = -0.70). For the other sectors low equity betas tend to correspond with positive bond betas, while high equity betas tend to correspond with negative bond betas, which is consistent with the findings of Blitz (2020). Although the energy sector does not have very remarkable equity and bond betas, it does

[5] The energy sector is even almost entirely absent in Paris-aligned benchmark indices, such as the ones from MSCI and STOXX. These indices follow EU regulation, which states that Paris-aligned benchmarks cannot invest in stocks that obtain a certain percentage of their revenues from fossil fuels (using revenue thresholds of 1% for coil, 10% for oil, and 50% for gas). However, these indices also exclude many other stocks, such as the entire tobacco industry, so they go well beyond mere fossil fuel exclusion.

[6] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[7] We do not subtract the risk-free return from the percent change in the oil price, because oil is a physical asset instead of a financial security. However, the results are very similar if instead of oil we take a tradable, self-financing alternative such as the GSCI Oil futures index return in excess of the risk-free return, because of the very high (over 95%) correlation between oil futures and spot price changes.

stand out with an exceptionally high oil beta compared to all the other sectors (t = 10.09).[8] The finding that energy stocks are highly sensitive to changes in the oil price is consistent with the findings of Sadorsky (2001), Scholtens and Wang (2008), and Mohanty and Nadha (2011). There is only one other sector, materials, with a statistically significantly positive oil beta (t = 3.36). All the other sectors have neutral or (significantly) negative oil betas.[9]

INSERT EXHIBIT 1 HERE

Exhibit 2 shows the total volatility of each sector, and the contribution of the market, bond, and oil exposures to this total volatility. These contributions are calculated by taking the absolute values of the estimated betas times the volatilities of the market, bond, and oil factors. The most notable observation is that oil risk is a major contributor to the volatility of the energy sector, which even causes the sector to end up with the second highest total volatility (after the information technology sector), despite having a market beta well below 1. Since the oil price has a volatility that is over 2.5 times the market volatility (38.1% versus 15.0%), even the seemingly modest oil beta of the energy sector (0.21) contributes a lot to the overall volatility of the sector.

INSERT EXHIBIT 2 HERE

Exhibit 3 shows that oil betas are very similar if we consider sectors at the regional instead of the global level. For this analysis we use sector data for the regions North America, EAFE (Europe, Australisia, Far East), and Emerging Markets, which is available from 2002 onwards, and repeat the regression using regional market factors and the same bond and oil series. The estimated oil betas of the energy sector are sizable and highly significant in each region, at 0.23 (t = 8.98) for North America, 0.16 (t = 7.01) for EAFE, and 0.15 (t = 7.14) for Emerging Markets. Moreover, the materials sector is again the only other sector with an economically and statistically significant positive oil beta, albeit considerably less strong than for the energy sector.

INSERT EXHIBIT 3 HERE

[8] This result is robust to including the factors in the 5-factor model of Fama and French (2015) as additional control variables in the regression. Consistent with Blitz and Swinkels (2021) we observe that the energy sector exhibits a highly significant exposure towards the HML value factor; however, controlling for this exposure neither affects the level nor the significance of its estimated beta towards the oil factor.

[9] The regression results may give the impression that excluding the energy sector might actually make the portfolio more neutral towards oil price changes, because energy is the only sector with a large non-zero oil beta. However, by estimating the oil betas jointly with equity and bond market betas, the equity market portfolio has an equity beta of 1 and an oil beta of 0 by definition, and the oil beta has the interpretation of oil exposure after controlling for market risk exposure. The equity market factor itself actually also has a highly significant beta of 0.13 (t = 6.45) towards oil price changes, implying that part of the equity risk premium may be a compensation for oil price risk. This exposure largely remains if energy is excluded.

4. Oil scenarios

In order to get a better feeling for the economic relevance of the oil exposure of the energy sector we examine sector performance during oil bull and bear markets. We qualitatively determine oil bull and bear markets based on the observed historical price pattern. Our classification is shown in Exhibit 4 and consists of 7 oil bull periods and 6 oil bear periods. The bull scenario occurs a bit more frequently than the bear scenario, at 61% versus 39% of the time. The most extreme bull scenario was in the 2000s, when the oil price went from a low of about $20 to a high of $140. The past decade, however, was mostly an oil bear market, with the oil price dipping below $20 again during the Covid pandemic in early 2020.

INSERT EXHIBIT 4

Exhibit 5 shows the annualized market-relative return of each sector during oil bull versus bear markets. In line with its high oil beta, the energy sector shows a strong outperformance during oil bull markets, and a strong underperformance during oil bear markets. Surprisingly, the materials sector exhibits very similar returns, despite having a much smaller estimated oil beta (0.06 versus 0.21 for energy). This suggests that the materials sector could serve as a pretty good substitute for the energy sector. By filling the gap that arises from excluding energy stocks with materials stocks, portfolio performance would have remained pretty similar during the historical oil bull and bear markets. However, it is questionable whether this qualifies as an acceptable alternative to investors who wish to divest from fossil fuel stocks, because, like energy, materials is a sector with high carbon emissions and environmental issues.

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The next best hedge in the equity market is the industrials sector, but this sector exhibits much less pronounced returns during oil bull and bear markets. Besides, it also contains many firms with a high carbon footprint, such as the airplane manufacturing and airline industries. The remaining sectors typically exhibit the opposite sensitivity to oil price changes, i.e. underperformance during oil bull markets and outperformance during oil bear markets.[10]

An obvious hedge outside the equity market would be oil futures, which are traded in the commodity derivatives markets. By systematically going long oil futures, positive

[10] Intuitively one might expect renewable energy stocks to be a good hedge for fossil fuel stocks, as they are also likely to benefit from rising oil prices. We tested this hypothesis using the MSCI Global Alternative Energy index, which contains 76 stocks that are mainly drawn from the utilities, information technology, and industrials sectors, with monthly return data available from February 2009 onwards. Unfortunately, it turns out that this index an oil beta of -0.03 (statistically indistinguishable from zero), so it fails to hedge oil price risk. This is consistent with the findings of Henriques and Sadorsky (2008), who find that alternative energy companies are more affected by technology stock prices than by shocks in the oil price.

returns are achieved during oil bull markets and negative returns during oil bear markets, similar to the market-relative performance of the energy sector. However, if the purpose of excluding energy stocks is to divest from fossil fuels then oil futures are unlikely to be considered as an acceptable hedging instrument. Thus, divesting from fossil fuel stocks comes down to actively betting against oil, and it seems that this risk cannot be hedged without taking on other (implicit or explicit) forms of fossil fuel exposure.[11]

5. Energy sector scenarios

Instead of looking at scenarios for the oil price we can also directly examine bull and bear markets for the energy sector. Exhibit 6 shows a classification of the sample into energy bull and bear markets, based on the market-relative performance of the energy sector. This classification is generally similar to the oil bull and bear market periods discussed in the previous section, with 74% overlap. The differences mainly arise because the two regime classifications are not entirely synchronous. Roughly speaking, the energy sector shows a strong outperformance until mid-2008, after which it became a steady underperformer. The bull and bear scenarios comprise 50% of the sample each. Interestingly, the return of energy over the entire sample is almost identical to the market return, suggesting that energy stocks offer neither a premium nor a discount in the very long run. This result is consistent with Sireklove (2016), Trinks, Scholtens, Mulder, and Dam (2018), and Plantinga and Scholtens (2021).

INSERT EXHIBIT 6

Exhibit 7 shows the annualized market-relative return of each sector during the energy bull versus bear markets. We observe that the energy sector outperforms by about 20% per annum during energy bull markets, whilst underperforming by the same amount during energy bear markets. This is an even more pronounced result than for the oil bull and bear markets discussed in the previous section. Again, the materials sector emerges as the best hedge, although significantly less effective than before, with less than half of the return compared to energy in the two scenarios. In line with the previous results, none of the other sectors provides a very effective substitute, with most of the other sectors even exhibiting an opposite performance pattern.

[11] A novel potential hedging instrument could be carbon emission allowances, such as the European Union Emissions Trading System (EU ETS). However, the limited available historical data indicates that the correlation between the price changes of EU ETS carbon emission allowances and oil is close to zero. Moreover, energy stocks do not exhibit a significant beta towards the price changes of EU ETS carbon emission allowances. However, we do not want to rule out the possibility that carbon emission allowances become more correlated with oil in the future, and hence evolve into a better hedge for energy stocks.

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Exhibit 8 shows the impact of excluding the energy sector on the total return of a global equity portfolio over an entire decade. Over the most recent decade from 2011 to 2020, which was mostly an oil and energy bear market, the removal of the energy sector would have boosted the return of the equity portfolio by almost 1% per annum. However, over the preceding decade from 2001 to 2010, which was mostly an oil and energy bull market, it would have lowered the return by more than 1% per annum.[12] These return differences of around 1% per annum translate into cumulative return differences of around 10% per decade. Thus, divesting from fossil fuel stocks is an active bet against oil that can have a substantial impact on equity portfolio returns over typical evaluation horizons.

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6. Conclusion

Inspired by the announcement of several large institutional investors to divest from fossil fuel stocks, we examine how this affects the systematic risk exposures of an equity portfolio. We find that fossil fuel stocks exhibit a highly significant positive exposure towards changes in the oil price, which means that fossil fuel stocks have an expected outperformance if the oil price rises and an expected underperformance if the oil price falls. The materials sector exhibits similar, albeit considerably less pronounced behavior.

Classifying the sample period into oil bull and bear markets we find that fossil fuel stocks indeed outperform strongly during oil bull markets and underperform strongly during oil bear markets. Surprisingly, the materials sector exhibits very similar performance in these two scenarios, despite its much lower estimated oil beta. However, a drawback of using the materials sector as a substitute for fossil fuel divestments is that this sector also tends to involve high carbon footprints and environmental issues. An even better hedge would be to invest directly in oil futures, but this is probably an even less acceptable alternative to investors who wish to exclude fossil fuel exposure from their portfolios. A possible direction for future research could be to search for certain stocks or other financial securities that offer a good hedge for fossil fuel stocks without having a heavy (implicit) involvement in fossil fuels themselves.

As an alternative to oil scenarios we also consider bull and bear markets of the energy sector itself, and find even more pronounced results. We find that the energy sector can outperform or underperform by about 20% per annum during energy bull versus bear

[12] The volatility of the portfolio without energy is almost identical to the volatility of the base-case portfolio, at 15.11% versus 15.03% (annualized). Thus, differences in the Sharpe ratio of the two portfolios are effectively driven by the differences in their average returns.

market. Again, the materials sector appears to be the best substitute, although in this case it falls short of matching the energy sector return. Altogether we conclude that although divesting from fossil fuel stocks appears to have a neutral effect on long term expected returns, it does make a portfolio vulnerable to significant underperformance during oil or energy rallies that can take place in the short and medium term.

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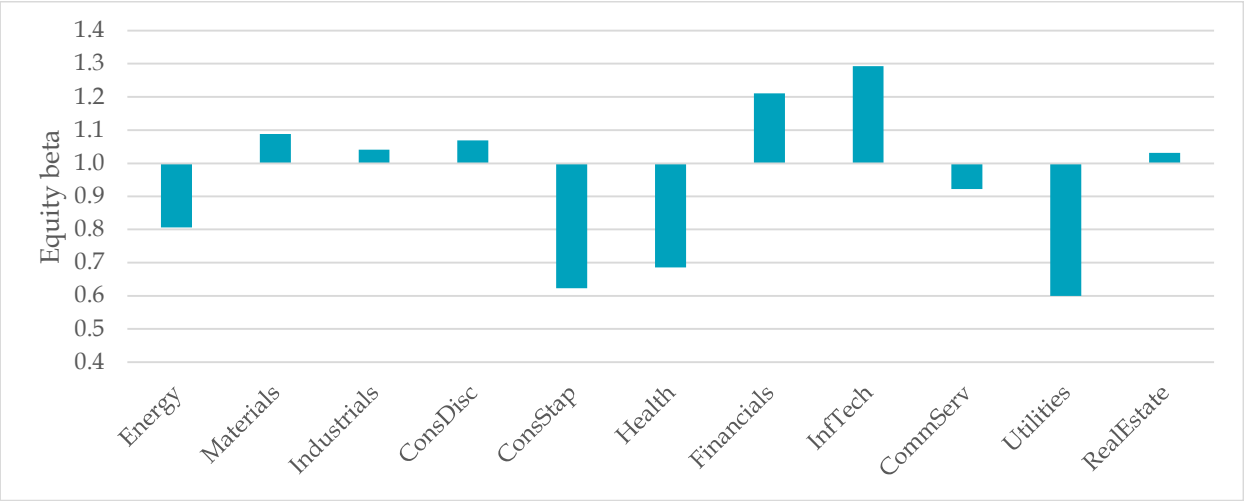
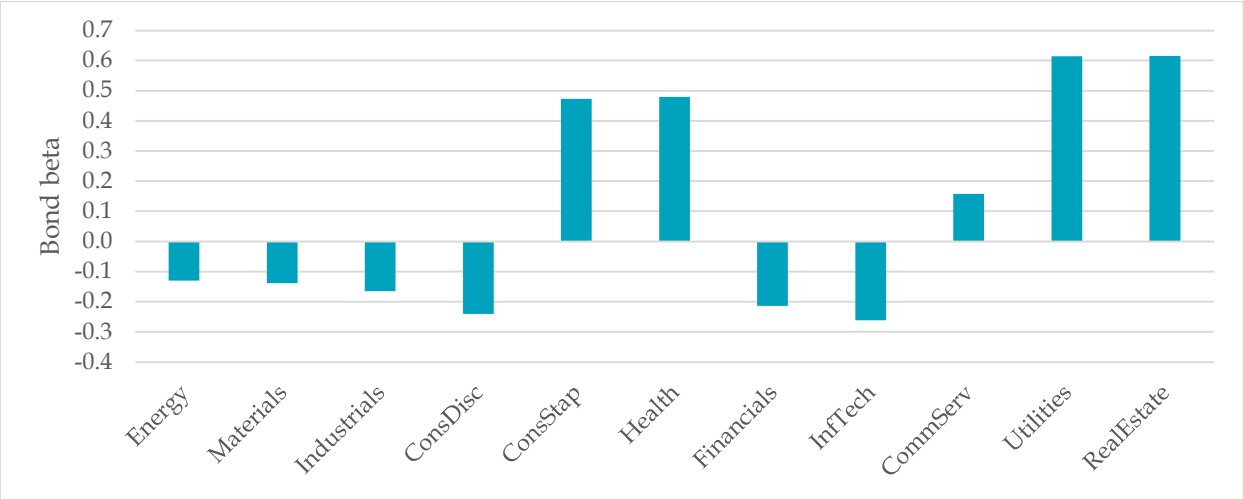
Exhibit 1: Equity, bond, and oil betas of global sector indices, 1995:01-2021:12





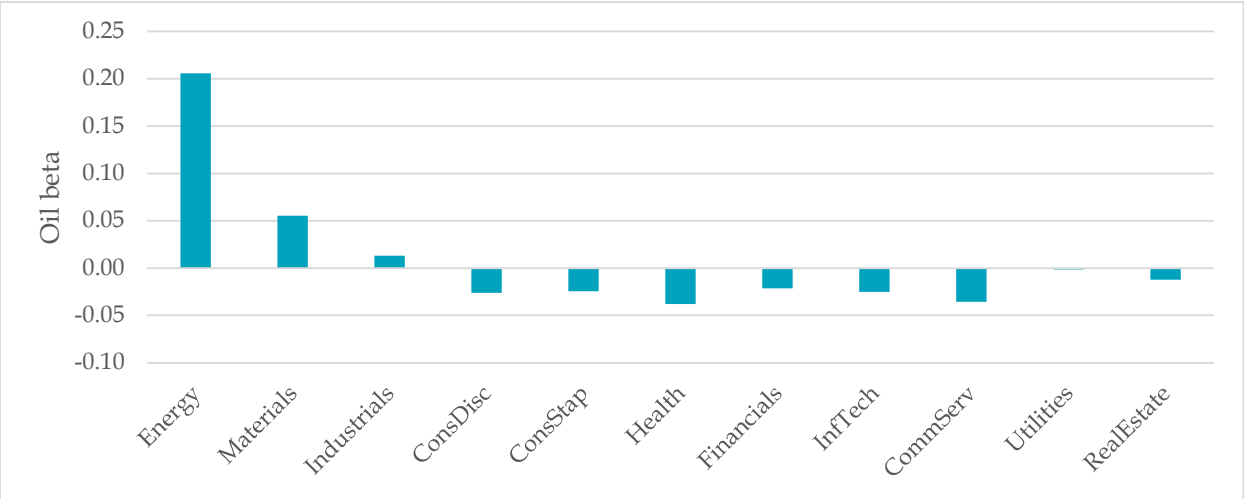


Exhibit 2: Volatility decomposition of global sector indices, 1995:01-2021:12

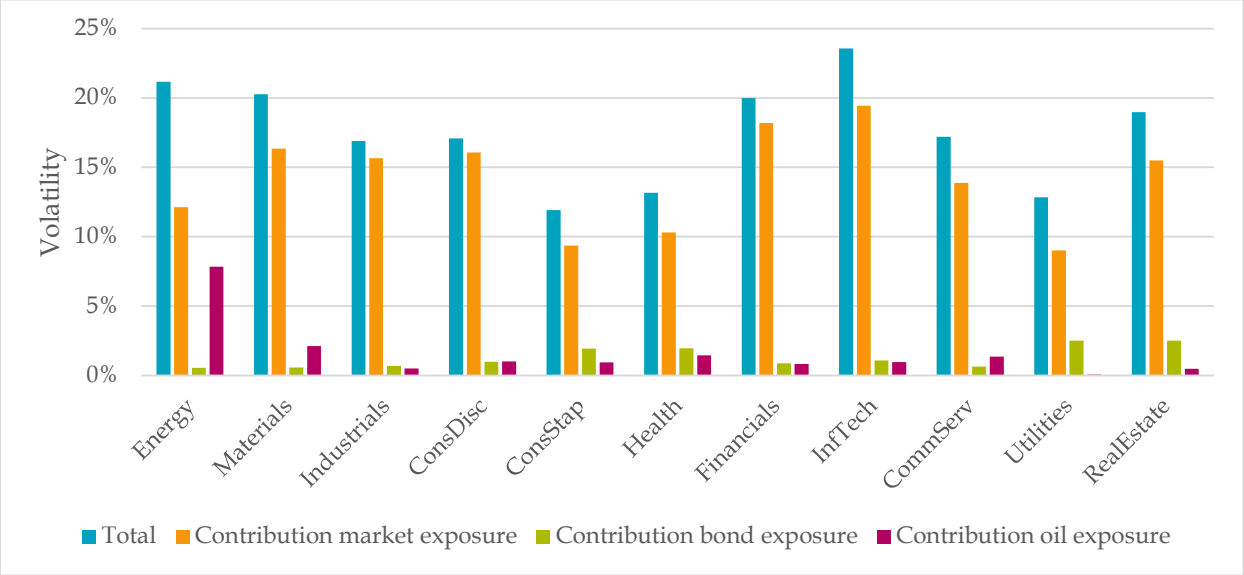


Exhibit 3: Oil betas of regional sector indices, 2002:01-2021:12

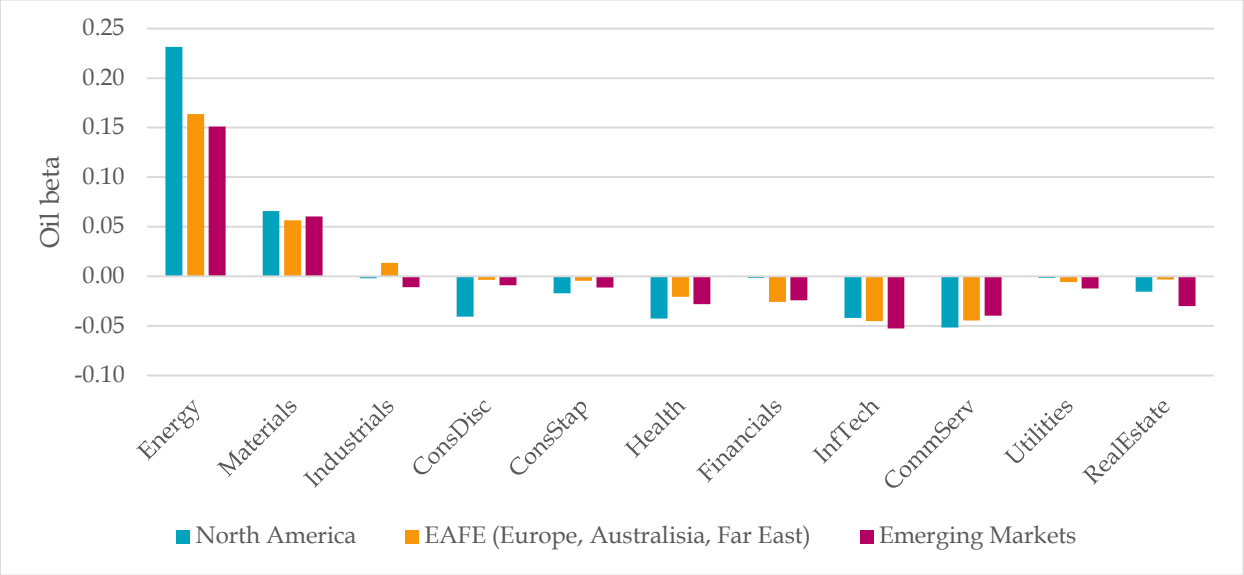


Exhibit 4: Oil bull and bear regimes, 1995:01-2021:12

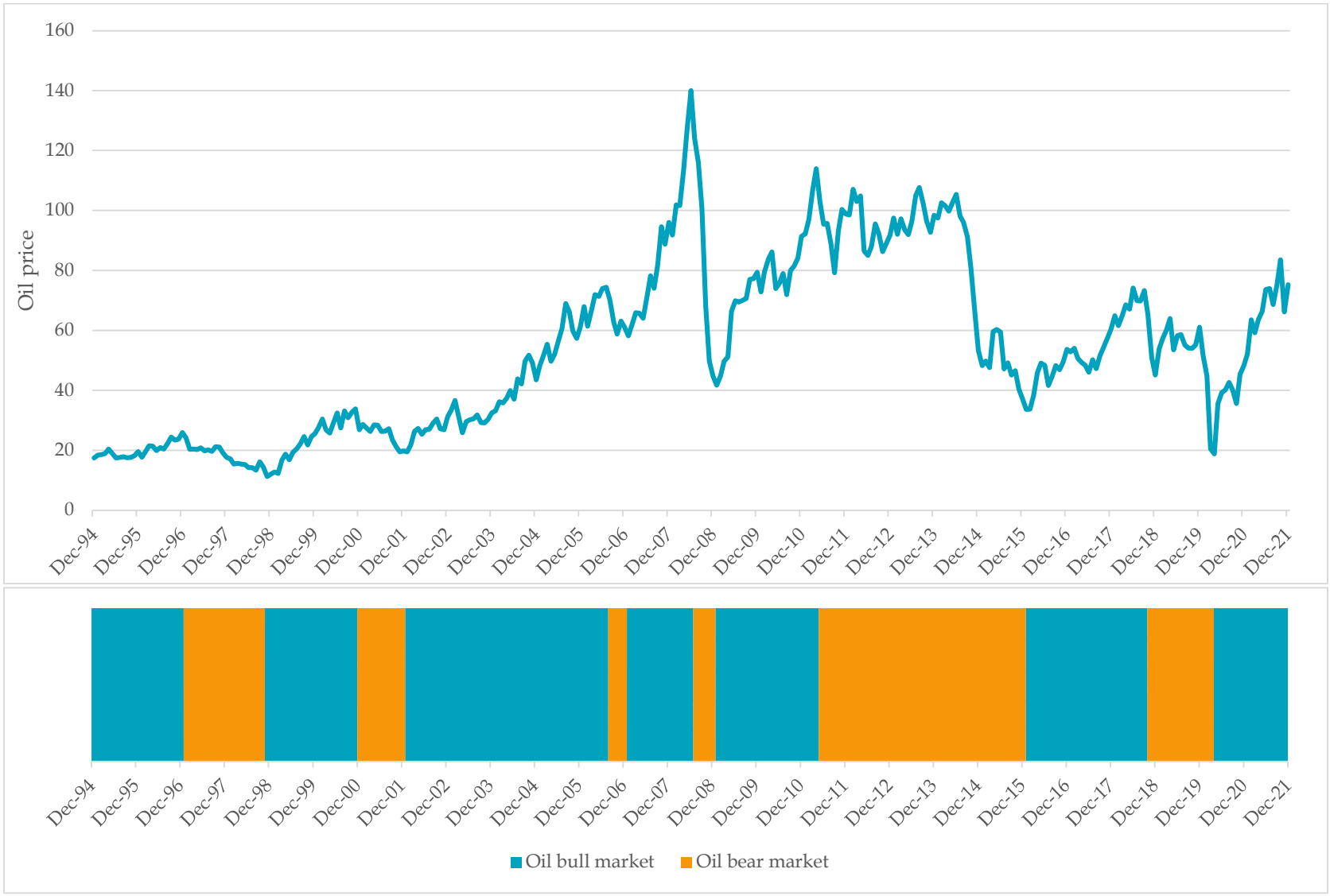


Exhibit 5: Sector performance during oil bull versus bear regimes, 1995:01-2021:12

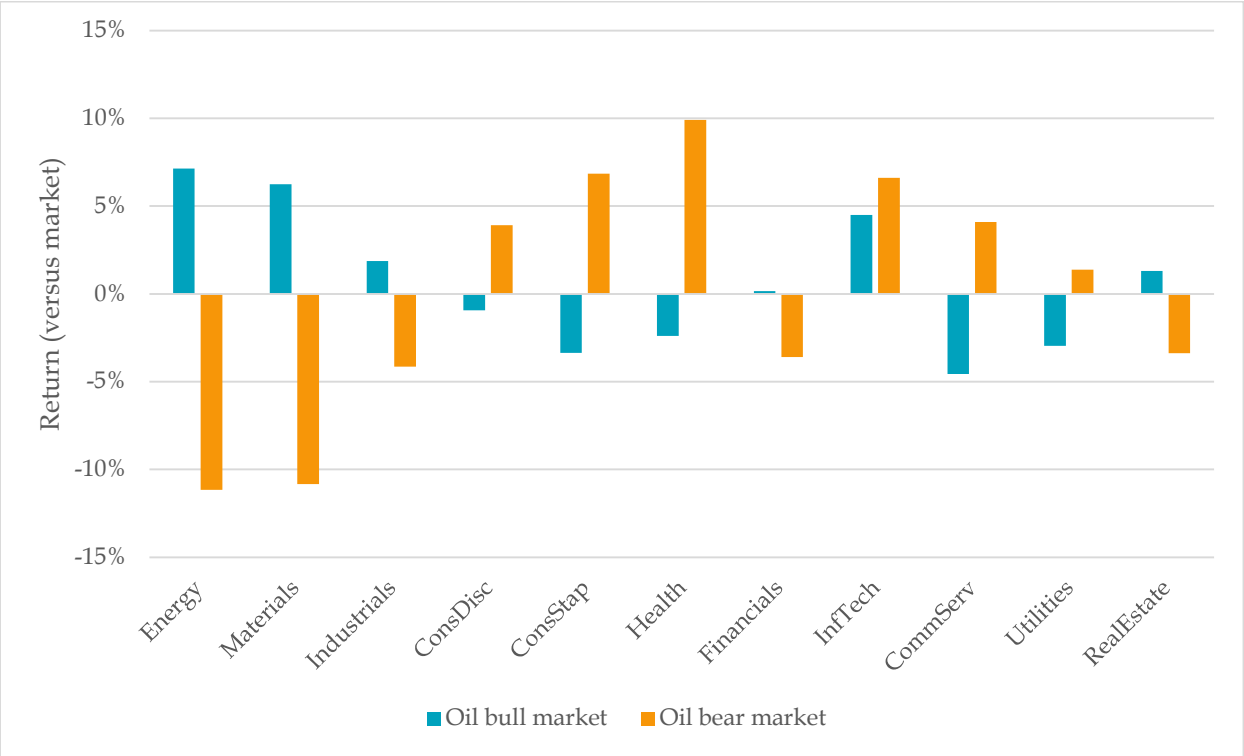


Exhibit 6: Energy sector bull and bear regimes, 1995:01-2021:12

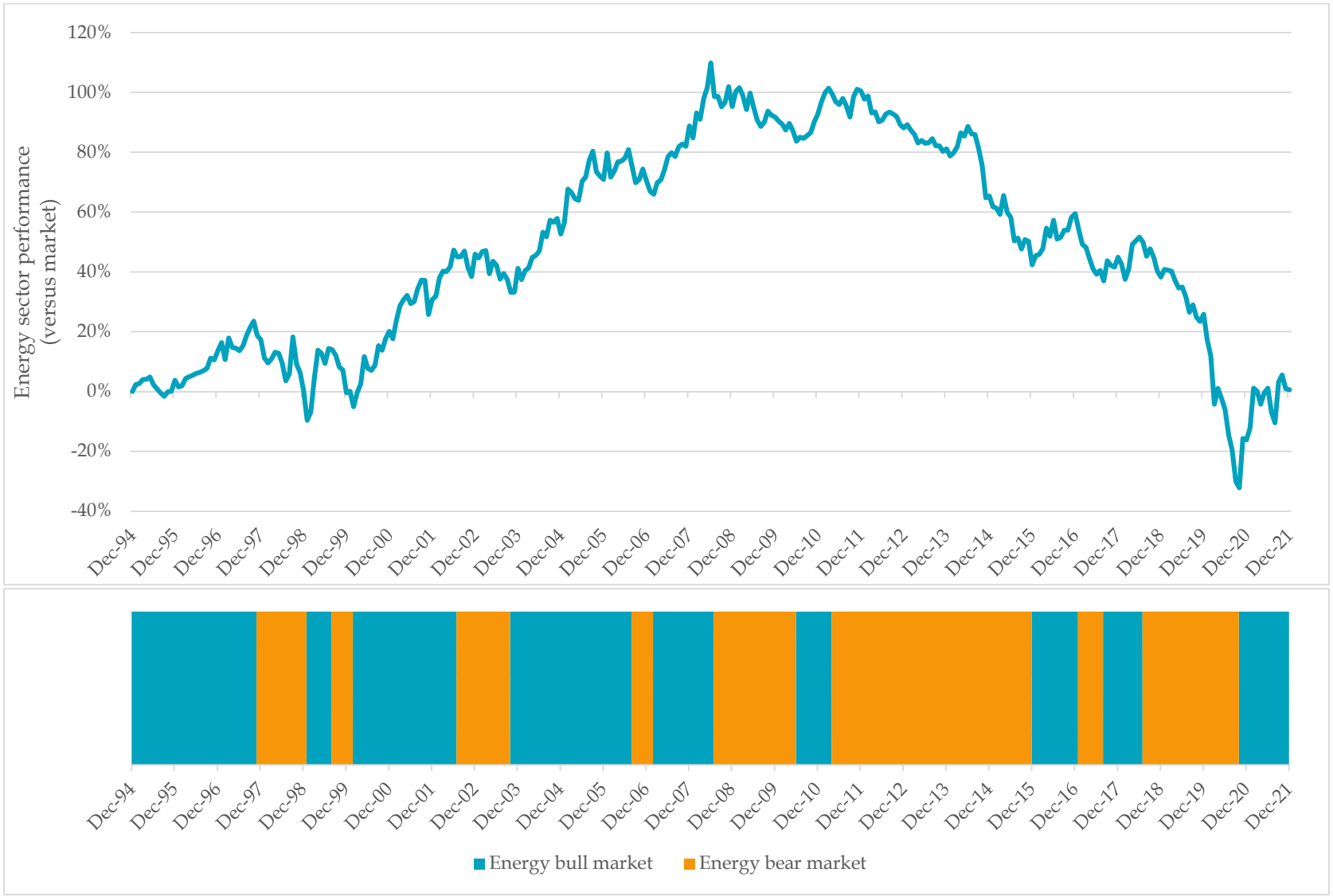


Exhibit 7: Sector performance during energy sector bull versus bear regimes, 1995:01-2021:12

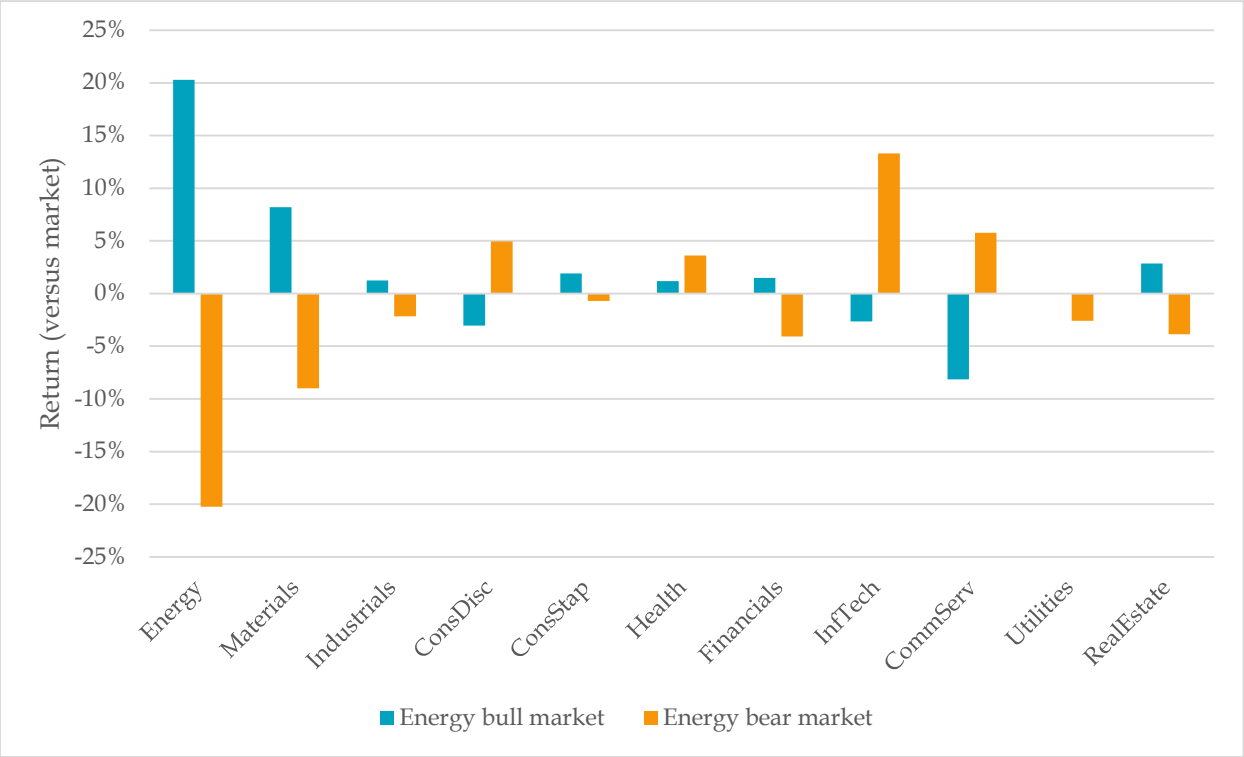


Exhibit 8: Return impact of excluding Energy sector from MSCI World index by decade