Special Feature: Market Developments and the Pace of Fossil Fuel Divestment

Primary commodity prices rose 24 percent between August 2021 and February 2022. Energy commodities, especially natural gas, drove the increase, due first to rising geopolitical tensions and later to Russia's invasion of Ukraine, while the Omicron COVID-19 variant created short-term volatility in late 2021. Base metal prices increased by 2 percent and precious metal prices rose by 3 percent, while agricultural commodities increased by 11 percent. This special feature also analyzes the pace of fossil fuel divestment. Anticipation of lower fossil fuel demand has likely reduced capital expenditures in oil and gas globally over the past three to four years—especially for publicly traded companies—reducing their investment by about 20 percent.

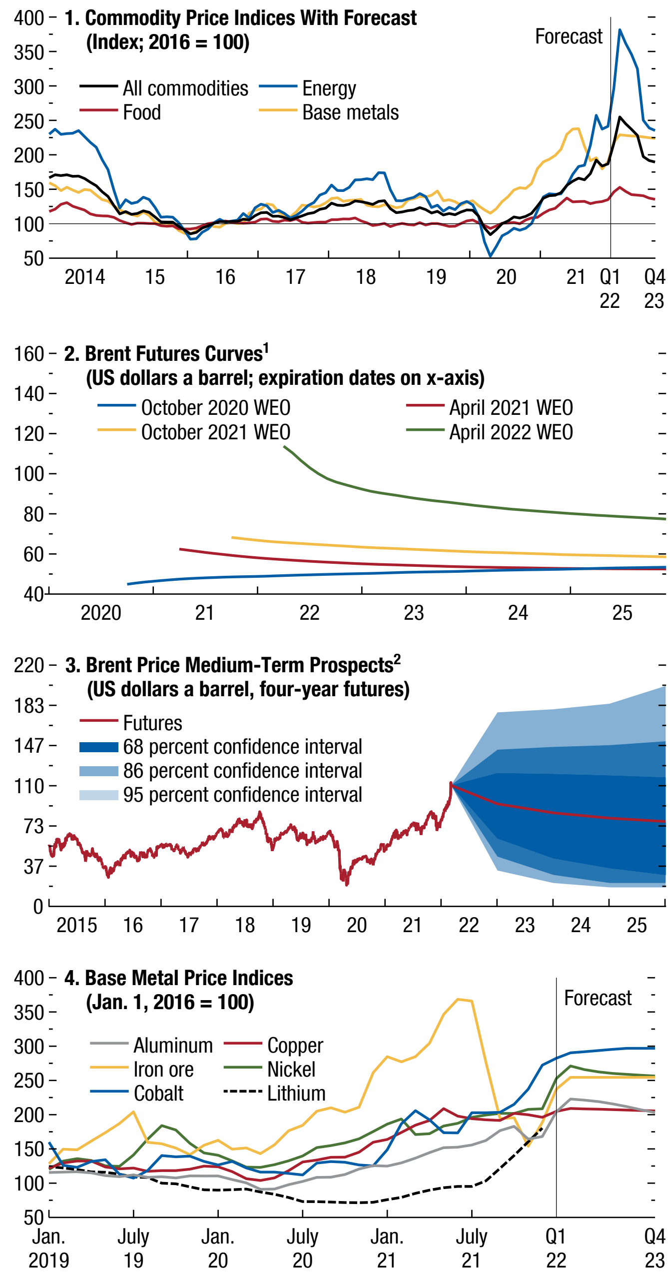
Oil and Gas Prices Up amid Ukraine War

Crude oil prices increased by 36 percent between August 2021 and February 2022, driven by a strong recovery in oil demand, with short-lived effects of the Omicron variant in late 2021, followed by geopolitical tensions and Russia's invasion of Ukraine in February 2022. Brent crude oil temporarily reached $140 in early March as markets started to shun Russia's Urals oil and several countries banned imports of Russian oil.

Supply was already tight before the war, as OPEC+ (Organization of the Petroleum Exporting Countries, plus Russia and other non-OPEC oil exporters) members continued to ease supply curbs at a measured pace and production in major non-OPEC+ countries increased slowly. Non-OPEC+ producers had been focused on cash generation rather than investment, partly because of the energy transition. More countries are now seeking to reduce dependence on Russian energy, so supply disruptions have so far been buffered by globally coordinated releases of strategic petroleum reserves, while spare capacity has not been tapped.

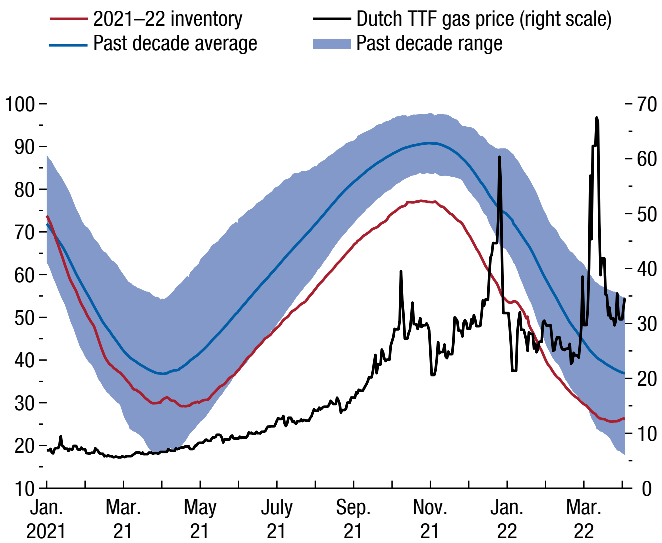
Global demand for oil in 2022 is projected to increase to 99.7 million barrels a day (mb/d) in 2022 (up 2.1 mb/d from 2021), according to the International Energy Agency—a downward revision of 1.1 mb/d compared with demand before the war in Ukraine. The risk of a major decline in Russian oil exports has caused a significant upward shift of the futures curve, with a spike in front-month futures prices (Figure 1.SF.1, panel 2). Futures markets suggest

Figure 1.SF.1. Commodity Market Developments



Sources: Bloomberg Finance L.P.; IMF, Primary Commodity Price System; Refinitiv Datastream; and IMF staff calculations.
Note: WEO = *World Economic Outlook.*
[1]WEO futures prices are baseline assumptions for each WEO and are derived from futures prices. April 2022 WEO prices are based on March 3, 2022 closing.
[2]Derived from prices of futures options on March 3, 2022.

Figure 1.SF.2. European Gas Inventory and Gas Price
(Percent; US dollars per million British thermal units)



Sources: Argus Media; Gas Infrastructure Europe; and IMF staff calculations.
Note: Last observation is Mar. 29, 2022. Past decade refers to 2011–20. TTF = Title Transfer Facility.

crude oil prices will increase 55 percent in 2022 and fall slightly thereafter, while short- and medium-term upside risks to oil prices remain elevated and include long-term downside risks from the energy transition (Figure 1.SF.1, panel 3).

Natural gas markets were driven by energy security concerns in Europe and low average storage levels going into last winter (Figure 1.SF.2). This led to greater competition with northeast Asia for spot cargoes of liquid natural gas, resulting in a global increase in natural gas prices, except in North America. Natural gas prices are expected to remain high until mid-2023 amid supply and energy security concerns, while Europe plans to reduce dependence on Russian natural gas. Coal prices rose 55 percent and reached historic highs in early March, reflecting tight supply-demand balances, production disruptions, and the shunning of Russian coal.

Metal Prices Rise to 10-Year Highs

The base metal index initially retreated from a 10-year high in July 2021, mainly owing to iron ore prices falling 13.8 percent amid temporary restrictions on steel production and slowing construction activity in China (Figure 1.SF.1, panel 4). The index began to recover in December as steel production curbs were lifted. Increased demand for electric vehicle batteries sent prices higher for cobalt, nickel, and lithium. The war in Ukraine and sanctions partially disrupted metal and mineral exports from Russia and Belarus. Precious metal prices increased thanks to an upward shift in inflation expectations.

Base metal prices are expected to rise by 9.9 percent in 2022, compared with a decline of 6.5 percent in the October 2021 *World Economic Outlook,* and to remain unchanged in 2023. Risks to the outlook are to the upside due to continued disruptions of trade in metals with Russia and higher energy costs. Precious metal prices are expected to rise 5.8 percent in 2022 and 2.1 percent in 2023.

Agricultural Prices Rise on War, Weather, and Higher Fertilizer Costs

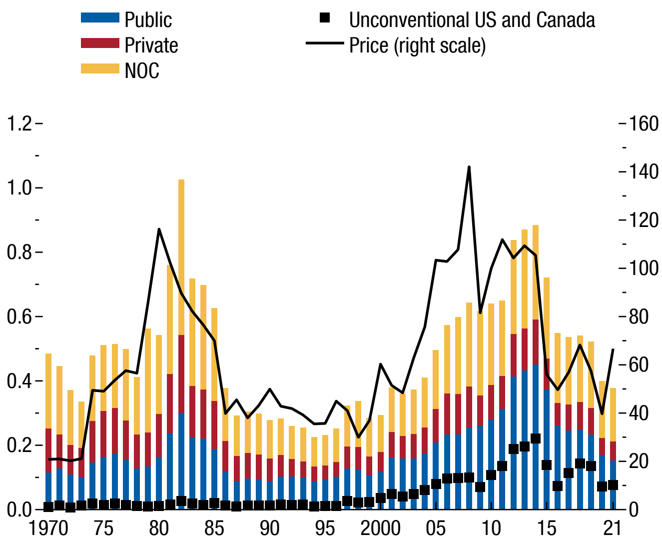
An increase of 17.2 percent in beverage prices and a 21.8 percent rise in cereal prices drove up the cost of food but was partially offset by a 5.3 percent decline in sugar prices and a 4.8 percent fall in vegetable prices. Wheat prices rose by 26.4 percent, as a severe drought in Canada and across the northern plains of the United States reduced spring wheat supplies. Looking ahead, a continuation of war in Ukraine—a major producer of wheat and corn—and falling Russian exports could fuel an additional surge in world cereal prices; adverse weather and fertilizer prices remain sources of upside risk for all food prices.

Pace of Fossil Fuel Divestment and Effect on Prices

The clean energy transition requires a substantial reduction in fossil fuel investment. The recent energy crisis, however, has raised concerns that, relative to the speed of adoption of renewable energy, the pace of divestment from fossil fuels is too fast, especially for oil and gas.[1] The next sections present recent trends in oil and gas investment and study their main drivers, examining the role of the shale boom, climate policies, and, more generally, the energy transition. They illustrate the starkly different effects that supply- and demand-side climate policies may have on prices of fossil fuels.

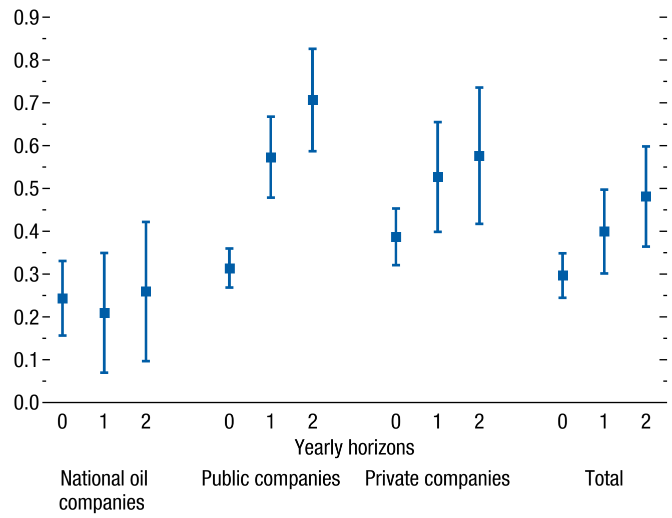
[1]Fossil fuels still account for more than 80 percent of primary energy consumption, globally (IEA 2021a). Three-quarters of the CO_2 reductions from a globally efficient mitigation in the next decade would come from reduced use of coal rather than of oil and gas.

Figure 1.SF.3. Oil and Gas Investment as Share of World GDP
(Percent; US dollars a barrel)



Sources: Bloomberg Finance L.P.; International Energy Agency; Rystad Energy UCube; US Bureau of Economic Analysis; and IMF staff estimates.
Note: The oil and gas price is the average of West Texas Intermediate crude oil and Henry Hub natural gas prices weighted by global oil and gas production, divided by US GDP deflator. NOC = national oil company.

Figure 1.SF.4. Price Elasticity of Global Oil and Gas Capital Expenditure



Sources: Rystad Energy UCube; US Bureau of Economic Analysis; and IMF staff estimates.
Note: Results are based on a regression of global nominal capital expenditures (in log differences) on two lags of an oil and gas price index (in log differences) plus controls, over the sample years 1971–2020. See Online Annex 1.SF.1 for details.

Oil and Gas Investment Has Declined Sharply since 2014

About half of total energy investment in 2021 was in fossil fuels—half of which was oil and gas *upstream* investment (IEA 2021a). The latter shapes the future production capacity of natural gas, crude oil, and condensates—and, thus, the supply of petroleum products, ranging from petrochemicals (such as ethylene and benzene) to jet fuel and motor gasoline.

After booming during the so-called shale revolution, global upstream oil and gas investment peaked at 0.9 (3.6) percent of global GDP (investment) in 2014. Since then, it declined to less than 0.5 (1.5) percent of global GDP (investment) in 2019, falling further during the pandemic (Figure 1.SF.3). The cyclical reversal disproportionately affected publicly traded companies, which cut oil and gas investment more than national oil companies—consistent with investment declining more notably in the Americas and Africa, as opposed to the Middle East and Russia.[2]

Swings in capital expenditure are not unusual in the oil and gas industry, though. Using data from 1970 to 2019, an empirical analysis shows that oil and gas prices are the main drivers of capital expenditure (Online Annex 1.SF.1). A 10 percent increase in oil and gas prices typically raises global oil and gas investment 3 percent in the same year and 5 percent after two years, cumulatively (Figure 1.SF.4). National oil companies tend to be less reactive since their investment decisions are often driven by a broader set of considerations.

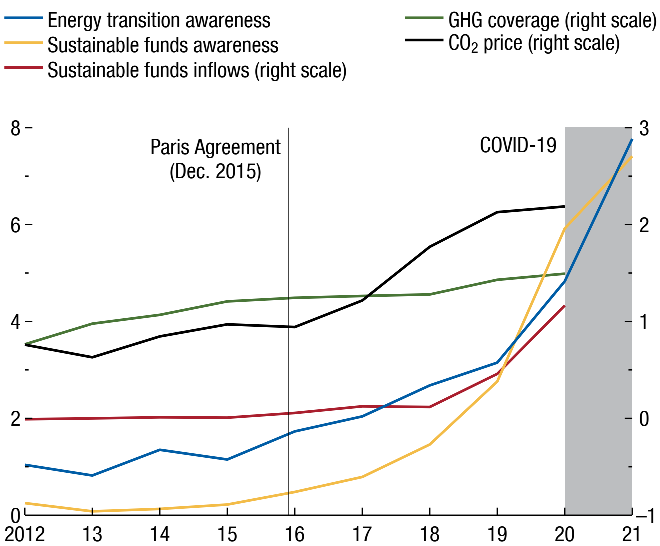
Fossil fuel investment followed a typical boom-bust cycle over the past decade. However, since oil and gas prices declined 50 percent between 2014 and 2016 and then recovered partially, the 40 percent decline in capital expenditure between 2014 and 2019 was deeper than the model's prediction, which suggests a 20 to 25 percent decline. While many factors could have been involved, the next section explores the role the clean energy transition may have played.

Climate Policies, the Energy Transition, and the Rise of Sustainable Investing

The energy transition affects oil and gas investment through three main channels: a *demand-side* channel related to existing demand-side climate policies (that is, carbon taxes on fossil fuel consumption); an *expectation channel* related to future fossil fuel demand

[2]The oil and gas investment share of the Americas and Africa (Middle East and Russia) combined declined (increased) by 2 (4) percentage points from 2010–14 to 2015–21, on average.

Figure 1.SF.5. Climate Policy and Energy Transition Indicators



Sources: Google Trends; World Bank; and IMF staff calculations.
Note: The proxies for energy transition and sustainable funds as well as the GHG coverage (in percent) were divided by 10 to adjust the scale. The price of CO_2 is expressed in dollars per ton. Sustainable funds inflows are presented as share of global gross fixed capital formation, in percent. GHG = greenhouse gas.

(for example, solar and wind investment subsidies or announced demand-side policies such as future bans on internal combustion engines); and a *supply-side channel*. Top-down supply-side policies (such as regulatory restrictions and bans on fossil fuel production) and bottom-up shifts in public preferences (such as portfolio shifts related to sustainable investment) increase the cost of capital for fossil fuel projects (see the April 2022 *Global Financial Stability Report*).

Supply- and Demand-Side Effects on Capital Expenditure

To study the three channels, a set of climate-related policy indicators based on hard and soft data was collected (Figure 1.SF.5 and Online Annex 1.SF.1). Text-based analysis captures public awareness of the energy transition (the expectation channel)—which increased sharply after 2018. The demand-side channel is captured by carbon taxes (CO_2 prices and greenhouse gas emission coverage by emission trading systems). Their increase slowed in 2019. The supply-side channel is captured by sustainable investing awareness and portfolio inflows into sustainable funds, which have both increased sharply since 2018.

A firm-level regression (see Online Annex 1.SF.1) is then used to assess the impact of the climate indicators on fossil-fuel-producing companies' capital expenditure (treatment group). Non-energy companies are used as the control group. Data are from 2012 to 2020, but the estimation sample excludes the pandemic period:

$$y_{ist} = a + \lambda D_s + (\beta_1 C_t + \beta_2 P_{oil,t}) D_s + \gamma X_{ist} + \varepsilon_{ist}, \quad (1.SF.1)$$

in which y_{ist} is log capital expenditure in firm *i*, group *s*, year *t*; *a* is a constant; D_s is the "treatment dummy," equal to 1 for oil and gas companies and 0 otherwise; $P_{oil,t}$ is the oil and gas price; and X_{ist} includes log total assets, debt-to-equity ratio, asset turnover, Altman credit strength, region, industry, and year fixed effects. C_t represents either a dummy since the Paris-Agreement on climate change in 2016 or a climate policy indicator. Energy companies in the treatment group derive most of their revenue from the upstream oil and gas sector and show little ability to diversify into green energy.

Estimation Results Point to Capital Investment Slump

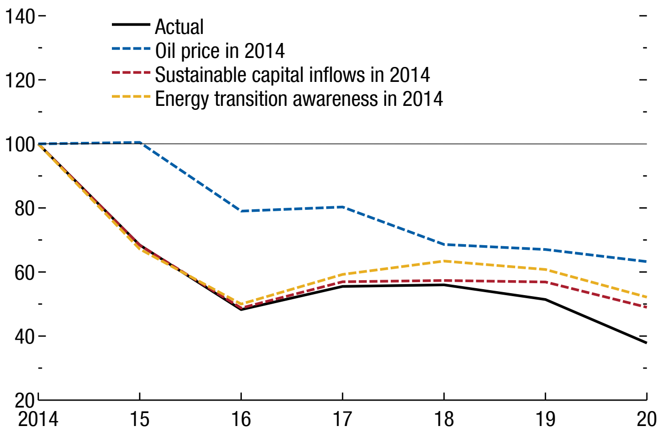
After the Paris Agreement, capital expenditure of a typical oil and gas company was 35 percent lower than that of the control group, even when factoring in firm-level variables, according to results shown in detail in Online Annex 1.SF.1. Part of that decline is explained by the effect of lower oil prices, which is related mostly to the shale boom-bust cycle and accounts for about half of the investment decline between 2014 and 2017 (Figure 1.SF.6). Between 2018 and 2020, however, the energy transition expectation channel was also a factor: if public awareness of the energy transition had been the same as in 2014, "brown" investment would have been 38 percent higher in 2020. The inflows into sustainable funds (supply-side channel) show a slightly smaller effect, even though their coefficient is not significant. The demand channel (that is, CO_2 prices and greenhouse gas coverage) is not significant, because its effect is either small or already subsumed by oil prices. The pandemic has likely further penalized brown investment, probably through unprecedented uncertainty, given that 18 percent of the 2020 decline is not fully explained by the econometric model.

Supply-Side Policies Could Propel Prices

How might climate *supply-* and *demand-side* policies affect prices? It is typically assumed that the energy transition would work as a negative demand shock

Figure 1.SF.6. Counterfactuals for Oil and Gas Captial Expenditure

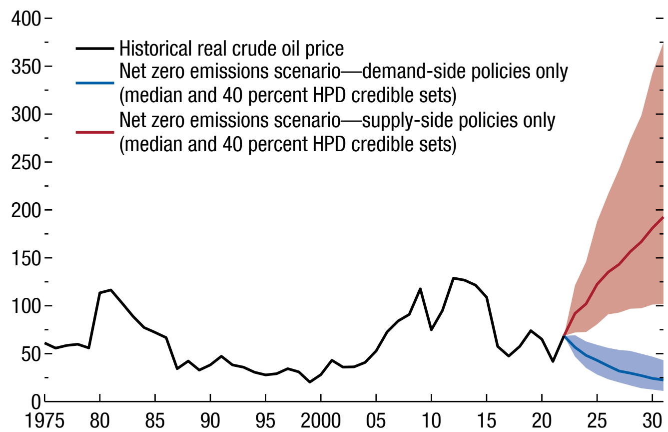
(Index)



Sources: Compustat; Google Trends; and IMF staff calculations.
Note: The dashed lines show in-sample scenarios for oil and gas captial expenditure in which either the oil price, the energy transition awareness proxy, or the sustainable funds inflow were held at their 2014 values.

Figure 1.SF.7. Oil Prices Rise in a Net Zero Emissions Scenario Driven by Supply Policies, Decline when Driven by Demand Policy

(US dollars a barrel)



Sources: Boer, Pescatori, and Stuermer (2021); British Petroleum; International Energy Agency; Schwerhoff and Stuermer (2020); and IMF staff calculations.
Note: Brent crude oil spot prices were adjusted for inflation using the United States Consumer Price Index with the base year 2020. See Boer and others (2021) and Online Annex 1.SF.1 for underlying data and methodology. HPD = highest posterior density.

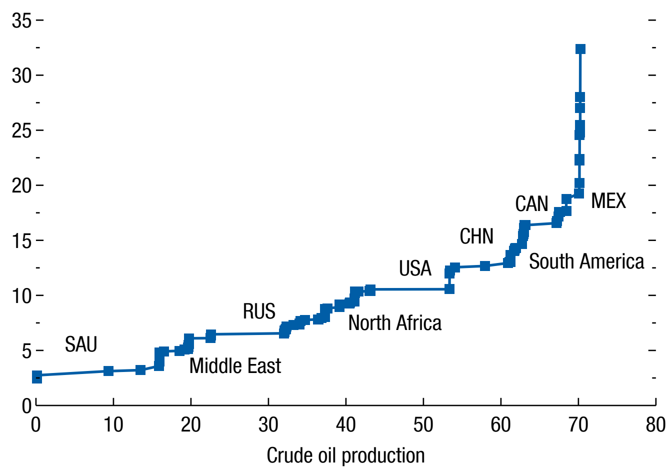
to fossil fuel prices. Subsidies for electric cars, for example, are a negative crude-oil-specific demand shock, since crude oil is replaced by electricity, leading to lower prices. However, a declining fossil fuel path can also stem from restricting investment flows into oil and gas because of sustainable investing pressures and other supply-side policies.

The case of crude oil highlights quantitatively how two different driving forces work in the International Energy Agency (2021b) Net Zero Emissions Scenario, in which crude oil production declines from 85 mb/d in 2020 to 66 mb/d in 2030. First, only demand-side policies are considered. In this hypothetical scenario, oil prices could decline to the $20s in 2030, with dire consequences for oil exporters (Figure 1.SF.7, blue line). Rents would diminish, and oil production would come under pressure in high-cost regions (Figure 1.SF.8).

Reductions in oil production that are driven hypothetically *only* by *supply-side* measures would, instead, exert strong upward pressure, taking prices to roughly $190 a barrel (Figure 1.SF.7, red line), benefiting producing countries at the expense of consuming countries. Since oil production would be profitable for all producers, the main determinants for the distribution of production and rents would be country restrictions, environmental regulations, and access to capital.

Figure 1.SF.8. Production in High-Cost Regions Would Be under Pressure in Demand-Side Scenario, Uncertain in Supply Side Scenario

(US dollars a barrel; million barrels a day)



Sources: Rystad Energy UCube; and IMF staff calculations.
Note: Production includes crude oil but excludes condensates and other liquids. The data set does not include all countries. Production costs refer to country averages. Data labels in the figure use International Organization for Standardization (ISO) country codes.

Consequently, the two hypothetical scenarios show that it is wrong to assume that fossil fuel prices will necessarily decline because of the energy transition. Instead, *supply-side* policies could exert upward price pressure, while *demand-side* policies would do the opposite. The reality is, of course, a mix of the two. If country policies are unpredictable and uncoordinated, the price effects of the energy transition are ultimately hard to determine, and this raises uncertainty.

Conclusions

Anticipation of lower fossil fuel demand and—possibly, but to a lesser extent—supply-side climate policies (including shifting public preferences for sustainable investing) have sapped capital expenditures in oil and gas globally over the past three to four years—especially for publicly traded companies, whose investment may have shrunk 20 percent during that time. This can put persistent upward pressure on oil and other fossil fuel prices, move production to less regulated producers, and add substantial uncertainty to the outlook for oil and gas prices. A coordinated climate effort among fossil fuel consumer and producer countries and divestment from fossil fuels at a pace commensurate with the speed of adoption of renewable energy would help reduce the risk of high and volatile energy prices. And less policy uncertainty would help countries make necessary adjustments.