

Energy, Economic Activity and Monetary Policy

Remarks by
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The views expressed by the author are her own and do not necessarily reflect those of the Federal Reserve System, its governors, officers or representatives.

Good afternoon. It's a pleasure to host this year's conference with President Kaplan and his team at the Federal Reserve Bank of Dallas. Combined, our two Federal Reserve districts serve an area of the central United States that accounts for almost half of the nation's energy production. This includes around 60 percent of its oil and gas production, as well as nearly 60 percent of the electricity generated by wind power. Obviously, energy plays an important role in our regional economies and employs a substantial number of workers, but it is also a central component of national economic activity with implications for monetary policy.

My remarks today will focus on this interaction of the energy sector and monetary policy. Energy plays a key role in determining the environment in which monetary policy operates. It is a direct component of economic output through production, employment and investment in the sector. Energy also creates indirect spillovers to other industries, government finances and consumers. At the same time, monetary policy, through its effect on interest rates and asset prices, has implications for the energy sector, primarily by shaping aggregate demand, but also through its impact on commodity prices and perhaps the structure of the industry.

Energy Production: Booms and Busts

I will start with some observations on energy's role in shaping the economy. Given the discussion earlier today, and the expertise represented in the forum, I will only briefly touch on the direct contribution of energy production to overall output, focusing primarily on tracing its indirect effects through other economic sectors. This is certainly not any indication of the lack of importance of direct effects. Booms and busts in the oil sector have led to large swings in employment and investment, particularly for regional economies that rely on the sector. Still, oil, gas and coal production accounts for roughly half a million jobs, or less than 1 percent of

national employment and around 1 percent of domestic output. While the sector itself is not that large in those terms, the jobs tend to pay high wages, and movements in employment affect spending and consumption within many communities.

Energy extraction also has a direct effect on aggregate output through capital investment. In particular, following the 2014 collapse in oil prices, energy investment took 2 percentage points off overall business fixed investment growth in 2015 and 2016, contributing to the overall weakness of investment over this period.

Among the biggest shifts affecting the energy sector today is the growth of renewable energy. Renewables now account for almost 20 percent of electricity generation, in part as the cost of solar power and wind power has fallen 85 and 70 percent, respectively, over the last decade.¹ As renewables continue to reshape the energy industry, there are likely to be shifts in employment, investment and output, with notable effects on regional economies.

While much has been said about the difficulty in dealing with the short-term fluctuations in renewable power generation, employment and investment have been relatively smooth, with shifts more likely in response to lower costs and government incentives than to volatile demand. With renewables continuing to gain market share, it may be that energy diminishes as a source of macroeconomic volatility. Certainly, U.S. energy prices and output are likely to become more insulated from global developments, the source of many energy sector shocks over the years. Without the geopolitics, energy could well become more boring, which is maybe not such a bad thing.

However, the direct effects of the energy sector likely capture only a small portion of the overall impact on economic output and growth. Energy is interwoven with all aspects of activity,

¹ <https://www.lazard.com/media/451419/lazards-levelized-cost-of-energy-version-140.pdf>

and developments in energy spill over widely. Given that the channels linking energy to the overall economy are incredibly complex and wide-ranging, I'll focus on four sectors — manufacturing, agriculture, government finances and consumers—which I believe illustrate the broader point: that an understanding of energy developments is essential for understanding economic developments more generally, and therefore give context for monetary policy. In highlighting these sectors, I will consider both cyclical movements, for example, the fall in oil demand and prices related to the coronavirus, and longer-term structural developments often driven by technological factors, such as fracking, the falling price of renewables, or the advent of electric vehicles. Admittedly, separating cyclical and structural effects can sometimes be difficult.

Manufacturing: Natural Gas and U.S. Comparative Advantage

I'll start with manufacturing. Energy is an important input into manufacturing, and fluctuations in the price and availability of energy have important spillovers for the sector. I will highlight one aspect of this: how the decline in the price of natural gas relative to oil has boosted the comparative advantage of U.S. manufacturing over the past decade, and how an increase in the relative price of natural gas could unwind that advantage.

As technological advances led to a sharp increase in U.S. natural gas production starting in 2006, the higher supply pushed down the price of natural gas relative to the alternatives and led industries to substitute towards natural gas and away from other energy sources. This was true for utilities, as has been well reported, but also manufacturers.² The decline in the relative

² In 2006, natural gas accounted for 28% of U.S. manufacturing energy usage. By 2018, it was 37%. Usage of natural gas liquids also rose from 11% to 15%. This mainly replaced coal and fuel oil (EIA, 2020: <https://www.eia.gov/todayinenergy/detail.php?id=45156>).

price of natural gas boosts the competitiveness of U.S. manufacturing, in part because U.S. manufacturers tend to use natural gas more extensively than their foreign competitors, who are often more oil-dependent. For example, oil's share in manufacturing energy consumption is more than five times higher in Europe than it is in the United States.³ This difference in energy usage is particularly notable in the refinery, petrochemical and plastics industries.

This comparative advantage is apparent in performance of U.S. exports. United States exports of refined petroleum products, petrochemicals and plastics increased 160 percent over the period from 2006 to 2019, while exports of the same products from Europe rose only 25 percent.⁴ During this period the United States became a leading exporter of gasoline and petroleum products and captured market share around the world. Overall, spillovers from low natural gas prices were likely an important support for U.S. exports in recent years and a contributor to the strength of economic growth.

Recent developments, however, threaten this comparative advantage. This year, oil prices have declined as natural gas prices have increased, in part as falling U.S. oil production has cut back on the supply of associated natural gas production. The relative price of Henry Hub natural gas to WTI oil fell by almost half over the period from 2006 to 2019, but ticked up by almost a third this year. If such a shift in relative prices were to persist, and futures markets suggest that it will, certain U.S. exports are likely to suffer a decline in competitiveness, and the aggregate economy is likely to face an additional headwind as we continue our recovery.

³ Oil is less than 2 percent of U.S. manufacturers' energy consumption (EIA), while it comprised 10.2 percent of European industry consumption in 2017 (EEA).

⁴ Data from WiserTrade, FRBKC calculations.

Agriculture: Electric Cars Don't Need Ethanol

The agricultural sector is also subject to spillovers from the energy sector, in part because agriculture is an energy-intensive industry, but also even more directly through ethanol. Corn used for ethanol accounts for more than a third of U.S. corn production. For perspective, the acreage devoted to corn destined for ethanol is equivalent to about 50,000 square miles, or 2/3 the area of the state of Nebraska. With demand for ethanol largely dependent on the demand for gasoline, fluctuations in gasoline consumption have important implications for the farm economy. As the pandemic compressed gasoline demand, there were immediate spillovers to the agricultural economy, and demand for ethanol fell off sharply.

In addition to the cyclical linkages, longer-term trends in energy usage also have ramifications for the agricultural sector. As motor vehicles have become more fuel efficient, domestic demand for ethanol has flattened out, even as increased exports have continued to support production. Looking farther ahead, quick advances in the technology around electric vehicles, as well as aggressive government mandates promoting electric vehicles in China and elsewhere, pose further challenges to the long-run outlook for ethanol. Somewhat ironically, the push toward electric vehicles is likely a significant threat to what is currently one of the largest sources of renewable energy in the United States.

Government: Finances under Threat

As energy-dependent states well understand, the performance of the energy sector also significantly affects state tax revenues and spending. Although severance taxes only make up around 1 percent of state tax revenues nationally, they play an outsized role in many energy-dependent states. Over the past five years, severance taxes have contributed more than 29 percent

of all state tax revenues in Wyoming and more than 45 percent of revenues in North Dakota and Alaska. Even in slightly more economically diversified states such as Texas, Oklahoma, West Virginia and New Mexico, severance taxes have exceeded 7 percent of state tax revenues on average.⁵

For states that rely on severance taxes, these tax streams are typically the most volatile component of revenues and can lead to large swings in tax collections.⁶ However, natural resource extraction has also been a blessing for many of these states, allowing them to build up large reserve funds in many cases.⁷

During the current crisis, most states have faced substantial budget shortfalls as tax collections have fallen in almost every revenue category and pandemic-related government spending has risen. In energy states, sharp drops in severance taxes have exacerbated these pandemic-related budget shortfalls. Thus, state governments in energy states are struggling. Large reserve funds can help to offset some of the decline in tax revenues, but most of these states will also be forced to make spending cuts over the next couple of years, likely creating a further headwind to the recovery.

In the longer term, many state governments in energy states will continue to look for ways to not only diversify their economies, but also to diversify their revenue streams. This will be particularly important for states that rely on revenue from commodities that are expected to face continued downward pressure over the longer term such as coal and natural gas. As one example, coal lease bonus payments contributed more than \$1 billion to school capital

⁵ U.S. Census Bureau. Quarterly Summary of State and Local Tax Revenues.
<https://www.census.gov/data/tables/2020/econ/qtax/historical/q2.html>

⁶ <https://www.pewtrusts.org/en/research-and-analysis/articles/2020/10/13/tax-revenue-swings-complicate-state-budgeting>

⁷ <https://www.nasbo.org/reports-data/fiscal-survey-of-states>

construction projects in Wyoming from fiscal year 2012 to 2017, but are expected to contribute less than half a million dollars over the next six years.⁸

Consumers: Are Gasoline Price Shocks a Thing of the Past?

Historically, particularly following the oil shocks of the 1970s, the most discussed, and perhaps most important, spillover from the energy sector has been the effect of gasoline prices on consumer spending. With households dependent on gasoline for transportation, changes in oil prices have a direct impact on household budgets. Higher gasoline prices decrease the amount that can be spent on other goods, which can be a drag on consumption and the economy. Similarly, lower gasoline prices boost the resources available to buy other goods and have historically supported consumption.

How important a gasoline price shock is to consumers depends on the share of gasoline in total expenditures. The lower the share of gasoline in total expenditures, the less important and the less likely that a change in gas prices will have a meaningful effect on overall consumption. Over time, the amount of household budgets devoted to gasoline has been falling, from about 4 percent in the 1980s to only about 2 percent in 2019, suggesting a declining importance of oil price shocks to overall macroeconomic volatility.⁹

That being said, the declining importance of oil in the aggregate masks considerable heterogeneity across the income distribution, with changes in gas prices being notably more important for low-income households. In the lowest-income quantile, gasoline accounted for more than 8 percent of household income in 2019, more than five times the budget share of the

⁸ http://eadiv.state.wy.us/creg/GreenCREG_Oct20.pdf

⁹ Total gasoline consumption increased by about 36% and 25% in the U.S. and the 10th District, respectively, from the 1980s to 2018 (last annual data point for states).

highest-income households. However, even for these lowest-income households, gasoline accounts for a smaller share in spending now than in the past.

The COVID-19 shock could further loosen the grip of gasoline prices on consumers' budgets and reduce the already lowered sensitivity of consumption to changes in the price at the pump. The pandemic dampened demand for gasoline as the volume of commuting fell off sharply with the rise in unemployment and increase in the number of employees working from home. Gasoline sales in April were off by a third of their pre-pandemic level. While mobility has increased with the lifting of stay-at-home restrictions, gasoline remains well below normal levels.¹⁰ One thing that seems unlikely to ever bounce back fully is the amount of commuting. With many workplaces offering, or likely to offer, increased workplace flexibility, not only is gasoline demand likely to be lower, but it is also likely to be more elastic. More elastic demand (with the caveat that not all jobs are tele-workable) should lower the volatility of overall consumption in response to gasoline price shocks.

Putting it all together, developments in the energy sector have widespread effects across the economy, both transmitting and amplifying near-term cyclical shifts, but also leading to longer-term structural trends. Energy shapes the context for economic growth and inflation, in both the near-term and long-run, arguing for monetary policymakers to keep a close eye on energy dynamics.

Monetary Policy's Influence on the Energy Sector

I will close with some thoughts on the influence of monetary policy on the energy sector. To the extent that direct and indirect spillovers affect the economic outlook, and thus monetary

¹⁰ EIA and Affinity Solutions.

policy settings, it is worth considering how monetary policy, and particularly the prospect of low-for-long interest rates, might affect the energy sector. There is a long literature that suggests, all else equal, that low interest rates should boost the price of storable commodities, such as oil, partly by incentivizing greater demand, but also by decreasing the incentive to produce.¹¹ Converting oil reserves into currency and other assets is less appealing when the return on alternative assets is low. In addition, there is a literature that suggests that low rates should lead to less-volatile prices. Interest rates are an important cost of holding inventory, so low rates should lower inventory costs and incentivize larger buffers that can then mitigate unexpected shifts in supply and demand.¹² Of course there are many other factors affecting oil prices besides interest rates, so low oil prices and continued price volatility can certainly coincide with low-for-long rates.

Again relying on “all else equal,” low rates should incentivize investment in the energy sector, and generally, by decreasing the cost of capital. This could be particularly true in the renewables sector, which has long-lived capital investment with high initial costs similar to utilities more generally. However, low interest rates can work not only by promoting new additions to the capital stock, but also through the acquisition of pre-existing capital—that is by encouraging mergers and acquisitions. In an industry with uncertain near-term and long-term demand, it might not be surprising to see low rates engender a greater response in M&A activity and consolidation as opposed to increased capital expenditure.

¹¹ See Jeffery Frankel ["The Effect of Monetary Policy on Real Commodity Prices"](#), Chapter 7 in [Asset Prices and Monetary Policy](#), John Campbell, ed. (U.Chicago Press), 2008: 291-327.

¹² See Gruber, Joseph and Robert Vigfusson “Do Low Interest Rates Decrease Commodity Price Volatility?” *IFDP Note* 2013-09-26, Board of Governors of the Federal Reserve System, 2013.