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# Hedging against Peak Oil Shocks

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*Many policymakers and pundits have argued that the United States should become "energy independent," in the wake of the rise in oil prices to more than $145 per barrel in summer 2008. In this* Outlook*, I investigate the economic benefits of domestic oil production by comparing the effects of oil shocks on energy- and non-energy-producing states in the United States. The results show that an increase in oil prices reduces economic activity in nonenergy states, but not in states where energy production constitutes more than 5 percent of gross state product. Oil shocks increase unemployment and reduce the number of jobs in non-energy-producing states, but they do not have a significant impact on unemployment or employment in energy-producing states. In some cases, an increase in oil prices actually reduces unemployment and creates jobs in states with a significant energy sector. Overall, the analysis shows that increasing domestic fossil-fuel production could potentially reduce unemployment, create jobs, and help jump-start the U.S. economy out of the Great Recession.*

The increase in the price of gasoline to more than five dollars per gallon and the rise in oil prices to more than $145 per barrel in summer 2008 have raised serious concerns among policymakers and the general public about the future cost of energy. A large rise in oil prices increases the cost of doing business (through transportation costs) and leads consumers to postpone purchases of consumer durables, such as cars and refrigerators, which can contribute to an economic recession. Indeed, every U.S. recession since World War II except one has been preceded by a large increase in oil prices.

In part to address this problem, many pundits and politicians have argued that the United States should make "energy independence" a public policy goal for economic and political reasons. Energy independence would also reduce the United States' reliance on foreign oil from governments that support terrorism and do not recognize basic human rights. Some people believe that the United States should develop alternative sources of energy because fossil fuels damage the environment by releasing carbon dioxide into the atmosphere.

For these reasons, Congress is considering a number of different policies to increase U.S. energy production. Some politicians are pushing for the development of alternative energies, such as wind, solar, and biofuel. Others support building new nuclear power generators to reduce the United States' reliance on fossil fuels for domestic

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### Key points in this *Outlook*:

- Increases in oil prices have frustrated consumers and led to calls for U.S. "energy independence."
- One of the best ways to combat rising oil prices is expanding domestic fossil-fuel production.
- This can actually reduce unemployment and create jobs in energy-producing states—and help steer the United States out of the recession.

electricity production. Still other scholars and experts point out that the United States should focus on developing domestic fossil-fuel reserves, given that alternative energy sources are generally not efficient or competitive with traditional sources of energy.[1] Indeed, the Energy Information Agency points out that fossil fuels will continue to be an important source of energy for the United States over the next several decades.

In this *Outlook*, I investigate the effect on the U.S. economy of an increase in oil prices. Consistent with previous studies, I find that a rise in oil prices reduces economic activity. I follow up the aggregate analysis by dividing U.S. states into energy- (for example, Alaska and Texas) and non-energy-producing states (for example, Connecticut and Massachusetts). I then use regression analysis to estimate the impact of an increase in oil prices on different measures of economic activity, including gross state product, unemployment, nonfarm employment, and mining employment over the period 1969–2007.

The empirical results show that an increase in oil prices has a different effect on energy- and non-energy-producing states. A rise in oil prices increases unemployment and reduces real gross state product and nonfarm employment in non-energy-producing states. For energy-producing states, however, a rise in oil prices does not increase unemployment or reduce the number of jobs. The results suggest that there are significant economic benefits to increasing domestic energy production.

The empirical analysis of oil prices and economic activity in the United States has several implications for policymakers. Expanding domestic energy production by increasing oil and natural-gas drilling and exploration is probably one of the best ways for the United States to protect the domestic economy against a large increase in oil prices. It will also help bridge the United States' transition to cleaner alternative sources of energy. This transition will take several decades, however, given that alternative sources of energy are often inefficient and have to be heavily subsidized by the federal government.

I begin this *Outlook* with an empirical analysis of the impact of oil prices on energy- and non-energy-producing states. This is followed by an investigation of the impact of a rise in oil prices on unemployment, nonfarm employment, and the mining sector. The *Outlook* concludes with a discussion of the implications for U.S. energy policy.

## Oil Shocks and the Macroeconomy

**Economic Activity.** To investigate the importance of oil and natural-gas production for the United States, I divide U.S. states into energy- and non-energy-producing states. I define an energy-producing state as one where energy production accounts for at least 5 percent of a state's gross state product. Using these criteria, the United States has six energy states: Alaska, Oklahoma, Louisiana, New Mexico, Texas, and Wyoming. In each case, fossil-fuel production is the most important component of energy production. Table 1 shows that energy production has averaged at least 5 percent for the six states over the entire sample period. Figure 1 shows oil production as a share of gross state product over the period 1963–2006. Oil production for the six energy-producing states peaked in the early 1980s before declining in the 1990s. Recently, oil production has increased largely because of the rise in energy prices.

Expanding oil exploration and drilling on public lands and offshore is likely to create jobs and help offset the negative effects of oil price shocks.

A large increase in oil prices is likely to have a much larger negative impact on a state's output if it does not produce oil or natural gas. A state with a large energy sector may actually benefit from an increase in oil prices. Alaska, for example, experienced double-digit real GDP growth as a result of the large increase in oil prices that stimulated the state's economy.

Using regression analysis,[2] I find that a one-standard-deviation increase in oil prices (25 percent) significantly reduces the rate of economic growth in non-energy-producing states by 1.015 percentage points over three years during the period 1969–2007.[3] A rise in oil prices does not have a statistically significant effect on economic growth in energy-producing states over the entire sample period, however.[4]

To further investigate the impact of oil shocks on economic growth, I re-estimate the regression model over various subsample periods (1969–85, 1986–99, and 1990–2007). The basic tenor of the results remains unchanged: a rise in oil prices reduces economic growth

in non-energy-producing states but does not have a statistically significant impact on energy-producing states. Clearly, the effect of a rise in oil prices on individual U.S. states depends on whether or not the state has a sizable energy sector.

**Unemployment.** Again using regression analysis, I find that a one-standard-deviation increase in oil prices (25 percent) increases unemployment over the period 1970–2008 by about 0.256 percentage points in all U.S. states and by 0.275 percentage points in non-energy-producing states. The impact of a rise in oil prices is very different for energy-producing states, however. Although the unemployment rate also rises for these states, by 0.108 percentage points, the effect is not statistically significant at the 5 or 10 percent level. The baseline unemployment analysis suggests that a rise in oil prices has a different impact on energy- and non-energy-producing states.

The same results hold true for several subsamples, including 1976–85, 1986–99, and 2000–2007. The only empirical result that is not consistent with the baseline results is the finding that an increase in oil prices did not significantly increase the unemployment rate for all states for the period 1990–2008. This is likely due to the fact that the U.S. economy expanded between 2002 and 2007 even as oil prices significantly increased. However, it is likely that the recent rise in oil prices led to an increase in unemployment, which can be verified once the revised state data for the years 2009 and 2010 are available. J. D. Hamilton argues that the large rise in oil prices played an important role in the onset of the current recession that was exacerbated by the financial crisis.[5]

TABLE 1

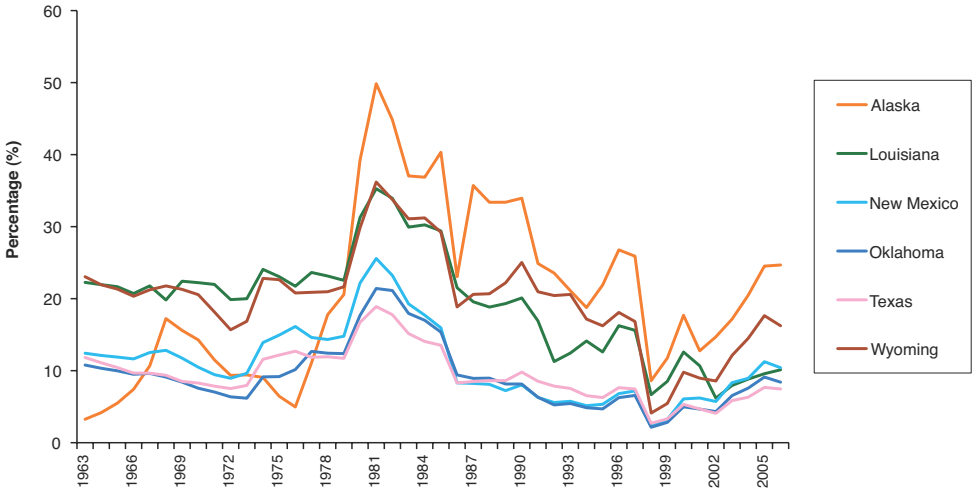
OIL PRODUCTION AS A PERCENT OF GROSS STATE PRODUCT

| | 1963–69 | 1970–79 | 1980–89 | 1990–99 | 2000–2006 | 1963–2006 |
|---|---|---|---|---|---|---|
| Alaska | 9.12 | 11.45 | 37.37 | 21.72 | 18.86 | 20.48 |
| Louisiana | 21.51 | 22.22 | 26.93 | 13.45 | 9.42 | 19.15 |
| New Mexico | 12.16 | 12.72 | 15.58 | 5.56 | 8.13 | 10.93 |
| Oklahoma | 9.68 | 9.31 | 14.60 | 5.25 | 6.52 | 9.20 |
| Texas | 10.08 | 10.36 | 13.01 | 6.76 | 5.91 | 9.39 |
| Wyoming | 21.56 | 20.10 | 27.36 | 16.49 | 12.54 | 19.96 |
| Average | 14.02 | 14.36 | 22.48 | 11.54 | 10.23 | 14.85 |

SOURCE: Author's calculations.

FIGURE 1

OIL PRODUCTION AS A PERCENT OF GROSS STATE PRODUCT, 1963–2006




SOURCE: Author's calculations.

**Employment.** I also investigate the impact of an increase in oil prices on nonfarm employment; the unemployment rate understates the number of unemployed during a recession because some workers exit the labor force.[6] The empirical results show that a one-standard-deviation increase in oil prices (25 percent) reduces nonfarm employment by 1.05 percentage points across all states over a three-year period. A different story emerges once I separate energy- and non-energy-producing states, however. Three years after a one-standard-deviation increase in oil prices, nonfarm employment rises by 0.41 percentage points in energy states and falls by 1.22 percentage points in non-energy states over the period 1970–2007.

The result also holds for the different subsample periods (1970–85, 1986–99, and 1990–2007). This analysis suggests that an increase in oil prices either increases nonfarm employment or does not have a statistically significant effect in energy-producing states, and significantly reduces nonfarm employment in non-energy-producing states.

**Mining Employment.** Mining is an industry that usually benefits from a rise in oil and energy prices. Using regression analysis, I find that a one-standard-deviation increase in oil prices increases employment in the mining sector by 1.41 percentage points for all states and by 4.39 percentage points and 0.96 percentage points for energy- and non-energy-producing states, respectively. The empirical result holds for the various subsample periods (1970–85, 1986–99, and 1990–2007). Overall, I interpret the empirical evidence as consistent with the hypothesis that an increase in oil prices has a different impact on energy- and non-energy-producing states. This suggests that increasing domestic fossil-fuel production—transforming non-energy-producing states into energy-producing states—would be beneficial.

**Risk Sharing.** Another potential benefit of increased domestic fossil-fuel production is that it would allow for greater risk sharing within and between U.S. states. This means that greater energy production, especially during negative oil or energy shocks, allows residents in energy-producing states to better maintain a constant stream of consumption and income—called income and consumption smoothing—given that energy-producing states tend to fare much better during an oil shock because of the wealth effects of energy production. The empirical analysis suggests that energy-producing states have nearly 50 percent more smoothing than non-energy-producing states over the period 1963–2007.

Most of the risk sharing in energy states is achieved through capital markets. One possible explanation for greater risk sharing in energy states is that residents of energy-producing states (as opposed to farmers and agricultural output) are more likely to hold claims on energy-producing assets (for example, own stock in an oil company) that can easily be bought and sold on capital markets to smooth consumption. Residents of non-energy-producing states are probably less likely to hold energy stocks in their wealth portfolios. This is consistent with the existence of home bias in wealth portfolios: the empirical finding that residents of a particular state are more likely to hold assets of local companies. Another benefit of increased domestic fossil-fuel production is that people can migrate to energy-producing states, where the job market tends to be much better, if there has been a recession accompanied by a large increase in oil prices.

## Conclusion

What are the economic effects of increased energy production? I explored this question by examining the impact of an increase in oil prices on the U.S. economy as well as on states where oil and natural-gas production are important economic sectors. Consistent with earlier studies, I found that a rise in oil prices reduces aggregate economic activity in the United States. But while most previous studies assumed that a rise in oil prices has the same impact on all U.S. states, I investigated the impact on energy- and non-energy-producing states.

An increase in oil prices reduces economic activity in nonenergy states, but not in states where energy production constitutes more than 5 percent of gross state product.

Based on my analysis, an increase in oil prices increases unemployment and reduces nonfarm employment in non-energy-producing states. This is not true in energy-producing states, however, where a rise in oil prices generally does not have a statistically significant impact on unemployment or nonfarm employment. In some cases, it actually reduces unemployment and increases the number of jobs in the state economy. This is most likely to occur in states where energy production is very important (like Alaska) and there are large spillover effects to the rest of the economy. These results suggest that the wealth effects of increased energy production are significant and important for mitigating the negative effects of a rise in oil prices.

This study has several implications for policymakers. First, it shows that analyses of oil price shocks on the entire U.S. economy suffer from aggregation bias. The impact of a large rise in oil prices on a U.S. state depends on the size of its energy sector. From a policy perspective, expanding oil exploration and drilling on public lands and offshore (in the Atlantic and Pacific

oceans) is likely to create jobs and help offset the negative effects of oil price shocks.

Finally, this analysis provides little insight into the possible benefits of increasing alternative-energy production (wind, solar, biofuel) in the United States. This is simply too difficult to determine on a macroeconomic level given that alternative energy accounts for a small fraction of total energy consumption in the United States. But alternative sources of energy are unlikely to be important in the near future because they are often inefficient and must be heavily subsidized. This means that expanding fossil-fuel production is an essential component of a broad energy policy that will help reduce the United States' reliance on imported oil and help the U.S. economy emerge from the Great Recession.

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## Notes

1. Newt Gingrich and Vince Haley, *Drill Here, Drill Now, Pay Less: A Handbook for Slashing Gas Prices and Solving Our Energy Crisis* (Washington, DC: Regnery, 2008).

2. Specifically, I employ a panel vector autoregression to estimate the impact of a one-standard-deviation increase in oil prices on the growth rate of real gross state product, state unemployment rates, nonfarm employment, and mining employment. Ninety-five percent confidence intervals are constructed using monte carlo methods. For a detailed description of the empirical analysis, see Marc D. Weidenmier, "Hedging against Peak Oil Shocks" (AEI working paper 2010-01, March 31, 2010), available at www.aei.org/paper/100096. Data on gross state product are provided by Moody's, while real international oil prices are measured as the West Texas Intermediate Crude divided by the U.S. consumer price index.

3. For the entire sample period, a one-standard-deviation increase in oil prices is approximately 23 percent.

4. The finding that a large rise in oil prices reduces economic growth is consistent with the findings of J. D. Hamilton in "Oil and the Macroeconomy since World War II," *Journal of Political Economy* 91 (1983): 228–48; "Historical Causes of Postwar Oil Shocks and Recessions," *Energy Journal* 6 (1985): 97–116; "This Is What Happened to the Oil Price–Macroeconomy Relationship," *Journal of Monetary Economics* 38 (1996): 215–20; "What Is an Oil Shock?" *Journal of Econometrics* 113 (2003): 363–98; and "Causes and Consequences of the Oil Shock of 2007–08" (Brookings Paper on Economic Activity, Brookings Institution, Spring 2009), 215–61. Hamilton, however, examines the impact of a large increase in oil prices on aggregate economic activity in the United States. He does not examine the effect of oil shocks on energy- and non-energy-producing states. L. Kilian examines the effect of oil-supply and oil-demand shocks on economic activity using a structural vector autoregression; see L. Kilian, "Exogenous Oil Supply Shocks: How Big Are They and How Much Do They Matter for the U.S. Economy?" *Review of Economics and Statistics* 90 (2008): 216–40; "A Comparison of the Effects of Exogenous Oil Supply Shocks on Output and Inflation in the G7 Countries," *Journal of the European Economic Association* 6 (2008): 78–121; and "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market," *American Economic Review* 99 (2009): 263–69.

5. J. D. Hamilton, "Causes and Consequences of the Oil Shock of 2007–08."

6. The unemployment rate is defined as the number of unemployed (people who do not have a job and are actively looking for one) divided by the size of the labor force. During a recession, many people often give up looking for a job and exit the labor force. As a result, the unemployment rate tends to understate the amount of unemployment during an economic recession.