The Local Economic Impacts of Natural Resource Extraction

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Shale Boom

- The past decade has been a dynamic one for the energy industry.
- During the early and mid-2000s, the combination of rising prices and technological advancements, led to the extraction of previously unrecoverable shale reserves.
- The shale boom saw the expansion of extraction activity in new geographic areas within the United States, including North Dakota and Pennsylvania.
- Since late 2014, oil prices have fallen due to a combination of global demand and supply factors.
Shale Boom

• What are the local economic implications of natural resource extraction?
• Resource booms lead to large increases in earnings and employment
• These labor market impacts have important secondary effects:
  – Education
  – Migration
  – Social insurance participation
• What are the underlying economic mechanisms?
• What are the magnitudes of these effects?
However, these time series mask some important local variation in production…

Source: Energy Information Administration
## History of the Shale Boom - Oil

<table>
<thead>
<tr>
<th>State</th>
<th>2000</th>
<th>2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>2,130</td>
<td>3,442</td>
<td>62%</td>
</tr>
<tr>
<td>Texas</td>
<td>443</td>
<td>1,262</td>
<td>185%</td>
</tr>
<tr>
<td>North Dakota</td>
<td>32</td>
<td>429</td>
<td>1241%</td>
</tr>
</tbody>
</table>

Source: Energy Information Administration
## Natural Gas Production (Bcf)

<table>
<thead>
<tr>
<th>State</th>
<th>2000</th>
<th>2015</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>2,000</td>
<td>2,800</td>
<td>40%</td>
</tr>
<tr>
<td>Texas</td>
<td>477</td>
<td>720</td>
<td>51%</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>13</td>
<td>429</td>
<td>3200%</td>
</tr>
</tbody>
</table>

Source: Energy Information Administration
Earnings and Employment Growth
• Resource price/technology shock shifts the labor demand curve outward from D to D’
• Earnings increase from Y to Y’
• Employment increases from N to N’
• In practice, the sizes of these effects depend on the slopes of the labor supply and demand curves
Clearly a positive relationship between prices and employment, but magnified during the shale boom.
Shale Boom and Earnings

• Overall, there were large increases in earnings in resource-rich areas:
  – Marchand (2012) finds a **22% increase in earnings per energy worker** in Canada from 1996 through 2006
  – Weber (2012) finds a **26% increase in earnings** in the Western U.S. from 1999 through 2008
  – Vachon (2015a and 2015b) find an approximately **30% increase in earnings** in Montana, North Dakota, and South Dakota from 2005 through 2010

• Other studies from the most recent boom as well as other booms are in line with these results
Shale Boom and Employment

- Overall, there were large increases in employment in resource-rich areas:
  - Feyrer, Mansur, and Sacerdote (2015) find that every million dollars is associated with an additional 0.78 jobs within the county.
  - Marchand (2012) finds a 47% increase in earnings per energy worker in Canada from 1996 through 2006.
Earnings and Employment

- While these earnings and employment effects are significant and garner much media attention, there are many secondary effects that may have more far-reaching impacts
  - **Education:** potentially suboptimal investment in education
  - **Migration:** large population changes that impact local governments
  - **Social insurance participation:** implications for federal and state governments
Secondary Effects:
Education, Migration, and Social Insurance
Economists and others have long been concerned with understanding how individuals respond to “random” changes in income.

The shale boom provides a natural experiment through which we can examine the impact of a change in earnings on various outcomes.
Education

- As earnings increase, the value to employment increases relative to the value of high school completion.
- Given that many oil and gas jobs are generally filled by lower-skilled, male workers, workers often substitute away from education and into the labor market during a boom.
- In 2000, the male high school dropout rate was 10% in states with shale reserves (Cascio and Narayan, 2015).
- The shale boom increased the dropout rate by 3 to 3.5 percentage points.
- These results suggest potentially suboptimal investments in education in response to an increase in earnings.
Migration

• Economic theory suggests that individuals will choose to live in an area that provides the highest wages for a given level of local amenities

• Earnings growth in oil counties **significantly increases** net migration

• Net migration rate in North Dakota oil counties **increased by 2.6 percentage points** (Vachon, 2015b)

• Economically sizeable effects
  – Pre-boom net migration rate was -1.5 percent (out-migration)
  – Impact of boom is +2.6 percentage points
  – Post-boom net migration rate is 1.1 percent (in-migration)
  – The boom transformed these counties from population-losers to population-gainers, making them among the fastest-growing counties in the country
Social Security Disability Insurance

• The Social Security Disability Insurance (DI) program is the **largest income replacement program** in the United States for non-elderly adults

• Growth in the DI program since the 1970s coincided with a well-documented decline in wages and labor force participation of low-skilled workers
Since **DI is more attractive as outside options decline**, a key question in labor economics is the extent to which changes in the labor economic conditions led to changes in DI program participation.

- Coal boom of the 1970s **reduced DI payments by 1.25%** decrease for coal counties relative to non-coal counties in Appalachia (Black, Daniel, and Sanders, 2002).

- Shale boom **reduced DI payments by 2.5%** for oil counties relative to no-oil counties in Montana, North Dakota, and South Dakota (Vachon, 2015a).

- Shale boom **reduced DI participation by 1.6%** for oil counties relative to no-oil counties in Montana, North Dakota, and South Dakota (Vachon, 2015a).
Decline in Oil Prices

• Nearly 70% decline in oil prices
  – June 2014: $105.48
  – September 2015: $34.66

• Due to a combination of supply and demand factors:
  – Supply
    • US shale boom
    • OPEC continues production
  – Demand
    • Lower than expected growth in Europe and China
Decline in Oil Prices

• Eight states with highest levels of energy industry employment
  – Alaska, Louisiana, New Mexico, North Dakota, Oklahoma, Texas, West Virginia, Wyoming

• Employment in these states will likely decrease with falling oil prices

<table>
<thead>
<tr>
<th>Oil State Employment Response to Decrease in Oil Prices</th>
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<tbody>
<tr>
<td>State</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>New Mexico</td>
</tr>
<tr>
<td>West Virginia</td>
</tr>
<tr>
<td>Texas</td>
</tr>
<tr>
<td>Louisiana</td>
</tr>
<tr>
<td>Alaska</td>
</tr>
<tr>
<td>North Dakota</td>
</tr>
<tr>
<td>Oklahoma</td>
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<tr>
<td>Wyoming</td>
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</tbody>
</table>

Source: Brown and Yucel (2013)
Decline in Oil Prices

• A decrease in oil and gas prices represents a negative shock to resource-rich areas that will reduce earnings and employment

• With regard to the secondary effects, falling incomes and employment opportunities should:
  – Reverse the observed trends in dropout rates
  – Reduce migration
  – Increase DI payments and participation