The Local Economic Impacts of Natural Resource Extraction

LSU Law Center
March 4, 2016

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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?

History of the Shale Boom

Oil and Natural Gas Production, 1991-2016
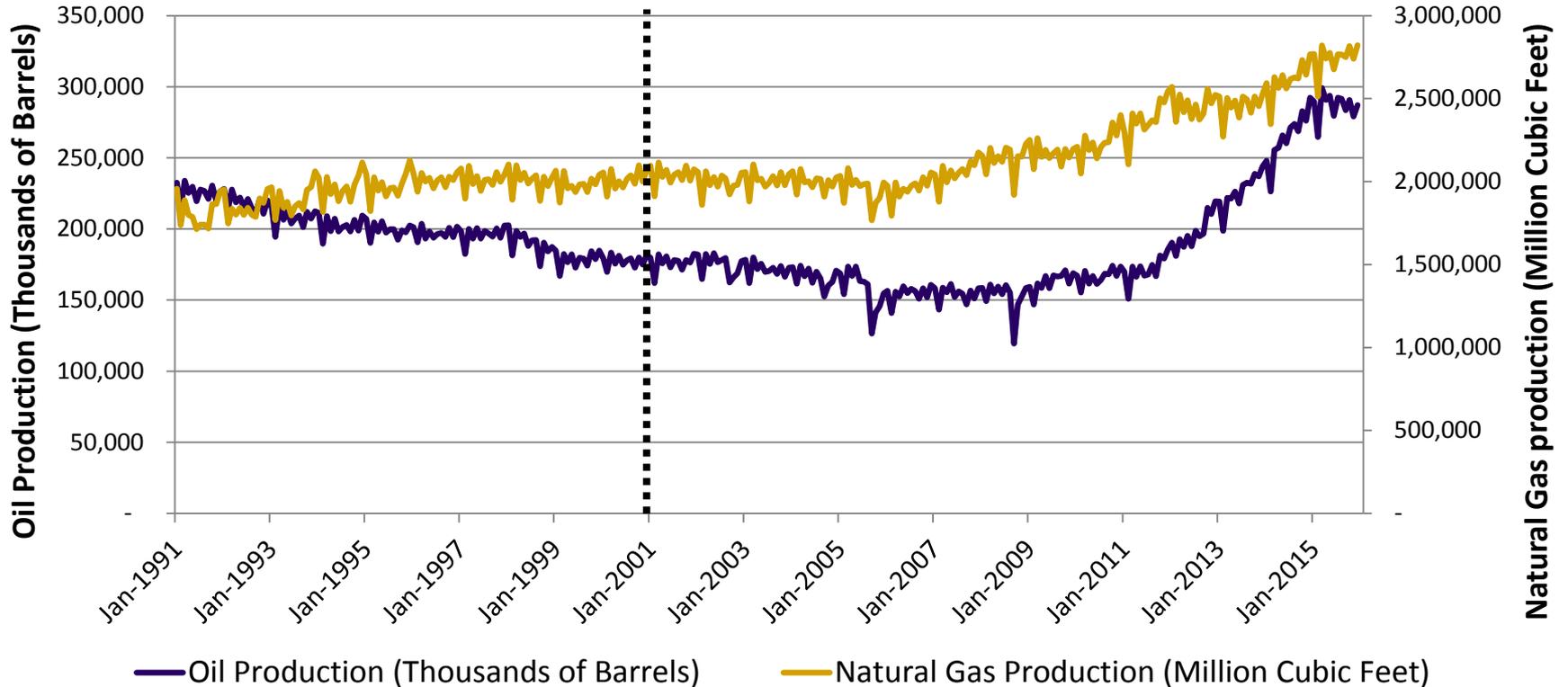
Source: Energy Information Administration

However, these time series mask some important local variation in production…

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History of the Shale Boom - Oil

Oil Production (Millions of Barrels)			
State	**2000**	**2015**	**Change**
United States	2,130	3,442	62%
Texas	443	1,262	185%
North Dakota	32	429	1241%

Source: Energy Information Administration
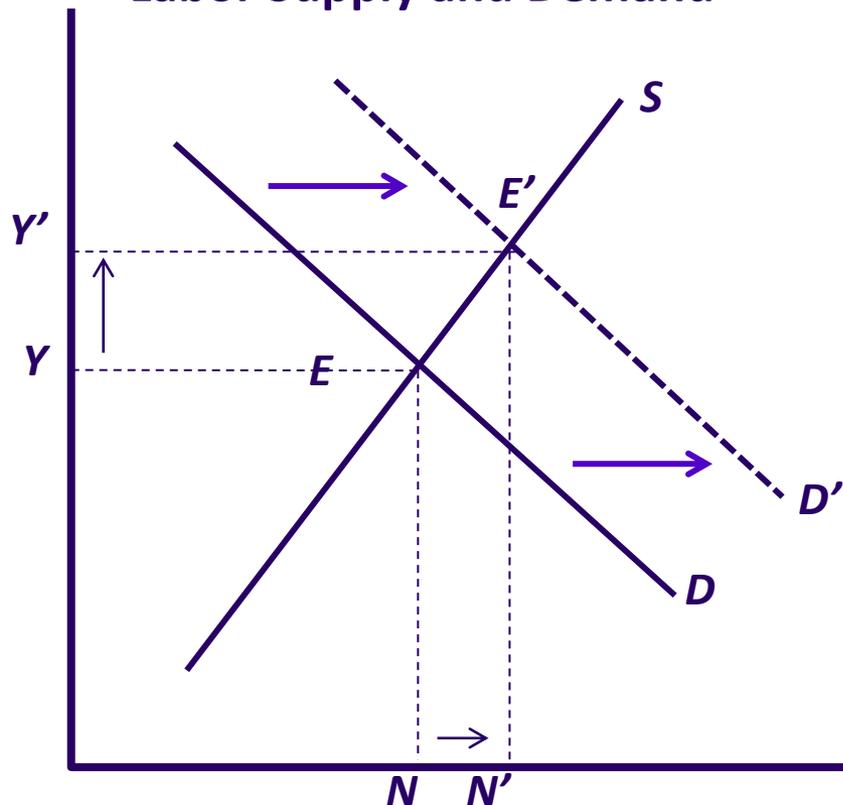
History of the Shale Boom – Natural Gas

Natural Gas Production (Bcf)			
State	**2000**	**2015**	**Change**
United States	2,000	2,800	40%
Texas	477	720	51%
Pennsylvania	13	429	3200%

Source: Energy Information Administration
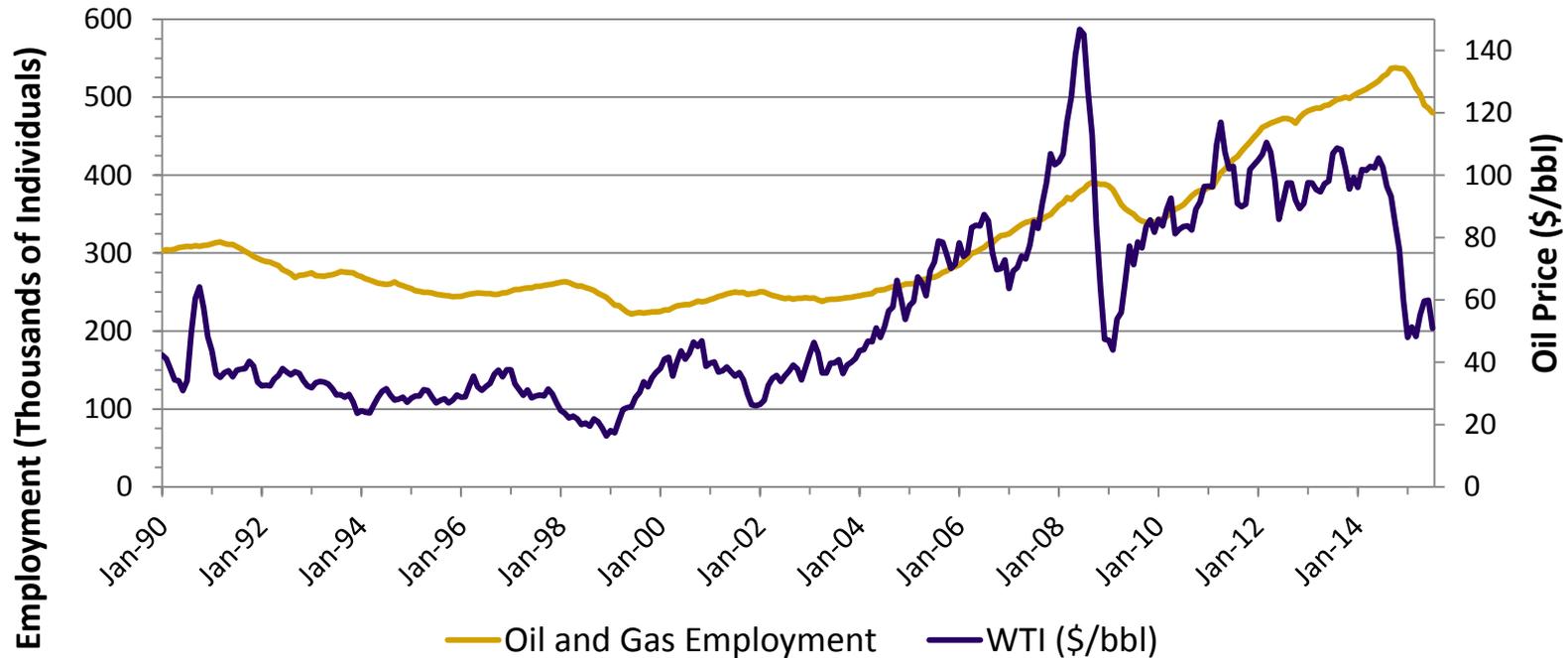
Earnings and Employment Growth

Labor Economics 101

Labor Supply and Demand

- 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

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Empirical Evidence

Oil Prices and Employment, 1990-2015

Sources: Bureau of Labor Statistics and Energy Information Administration

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

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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

Economic Mechanism

- 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

Social Security Disability Insurance

- 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

Oil State Employment Response to Decrease in Oil Prices	
New Mexico	-0.7%
West Virginia	-0.7%
Texas	-1.2%
Louisiana	**-1.6%**
Alaska	-1.8%
North Dakota	-2.0%
Oklahoma	-2.3%
Wyoming	-4.3%

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

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