

# **Impact of Oil Boom and Bust on Human Capital Investment in the U.S.**

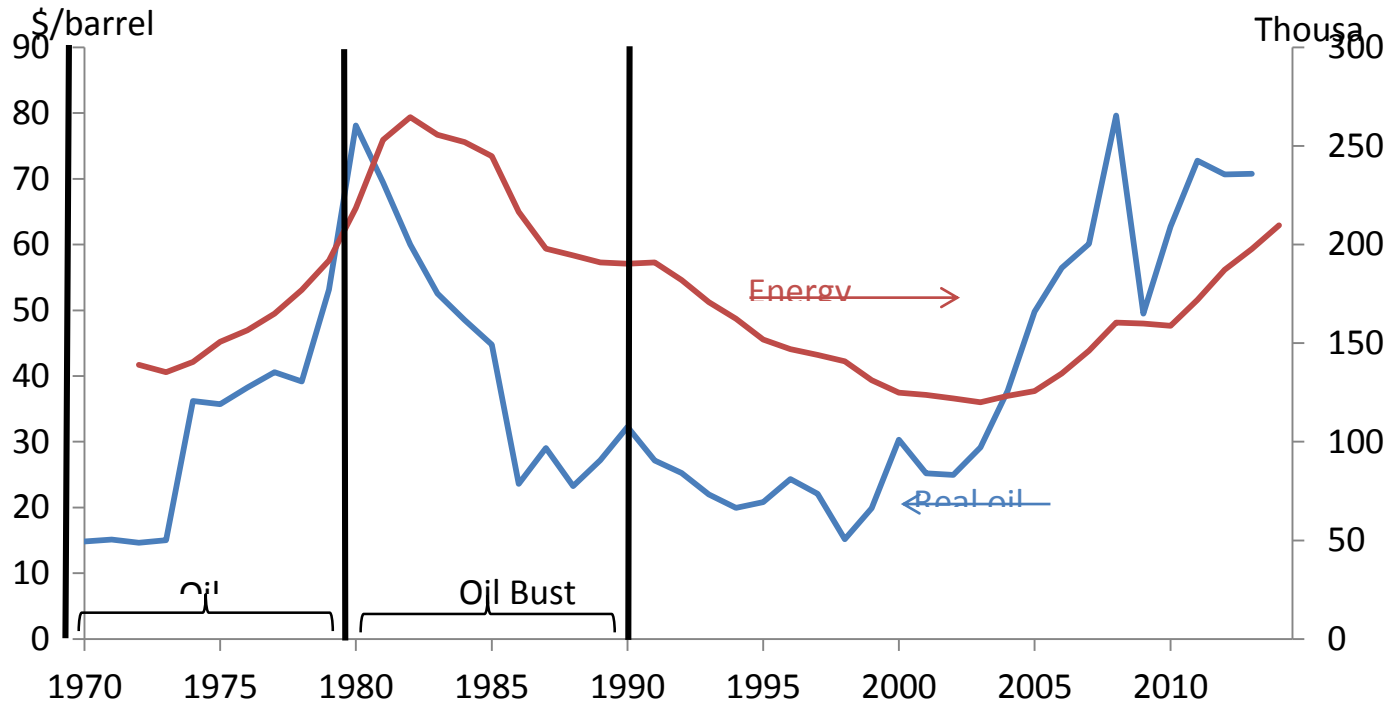
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# Motivation

- Energy sector playing increasingly important role in the U.S.
- Multiplier effects of resource booms get all the attention
- Long commodity price booms can deter human capital investment
  - Coal boom led to lower high school enrollment
- Important implications for net economic impact of prolonged resource booms
  - Education has positive externalities

# Oil Price Booms and Busts



Source: Federal Reserve Bank of St. Louis FRED.

# Potential Labor Market Effects of Prolonged Oil Booms

- Effect on wages
  - Decline in aggregate wages
  - Increase in oil-rich regions
- Effect on skill premium
  - May increase relative demand for unskilled labor
  - Depends on capital/energy and capital/skill complementarities
- Impact of boom on human capital investment
  - Raises opportunity cost of additional schooling
  - Lowers college wage premium
  - May deter human capital investment

# This Paper

- Did the oil boom adversely affect human capital investment in oil-rich regions?
- Use Census and American Community Survey (ACS) data from 1970 to 2010
- Investigate impact of oil boom and bust on
  - Real wages
  - Skill premium
  - Human capital investment
- Primary findings
  - Oil boom drove up real wages in areas with large energy sector
  - Small negative impact on college enrollment

# Previous Research on Oil Price Shocks

- Almost all the focus on macroeconomic effects
- Some research on labor market reallocation
- Primary focus on wages/employment
- Diverse findings
- Not much work on impact of oil boom/bust on local labor markets
- Very few studies on skill premium/human capital investment in oil-rich regions

# Previous Literature

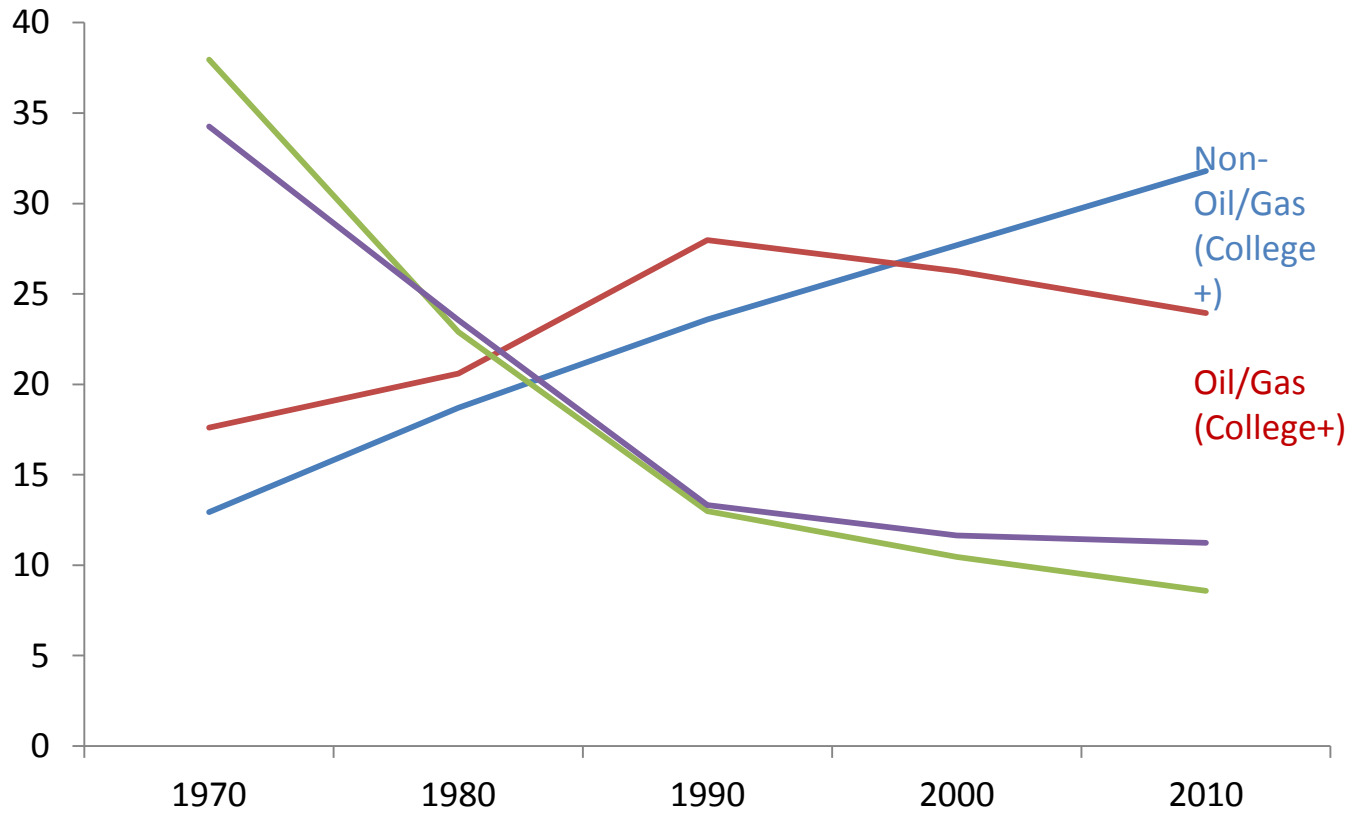
- Coal boom and bust
  - Black, McKinnish, & Sanders (2005)
- Resource booms and human capital
  - Gylfason, Herbertsson, & Zoega (1999)
  - Gylfason (2001)
- Oil price shocks and wages/skill premium
  - Negative effect on wages
  - Keane & Prasad (1996): wider skill premium
  - Polgreen & Silos (2009): narrower skill premium
- Fracking boom increased high school dropout rates
  - Cascio and Narayan (2015)
- 1970-80 oil boom led to lower college enrolment in Texas
  - Kumar (2015)
- Oil boom and human capital investment
  - Emery, Ferrer, & Green (2012): Canada

# Data

- 1% Census IPUMS for the years 1970, 1980, 1990, 2000, and ACS for 2010
- Sample restricted to employed workers with positive wages and hours.
- $\text{Wage} = \text{annual wage and salary income} / \text{annual hours worked}$
- $\text{Annual hours worked} = \text{weeks worked last year} \times \text{hours worked per week}$
- Oil Area defined as county groups with  $>2\%$  employment in oil and gas sector,
  - Non-oil area  $<0.5\%$ .



# Worker Shares by Educational Attainment: Oil & Gas Vs. Non Oil/Gas



## Percent Change in Worker Share by Educational Attainment (1970-1980)

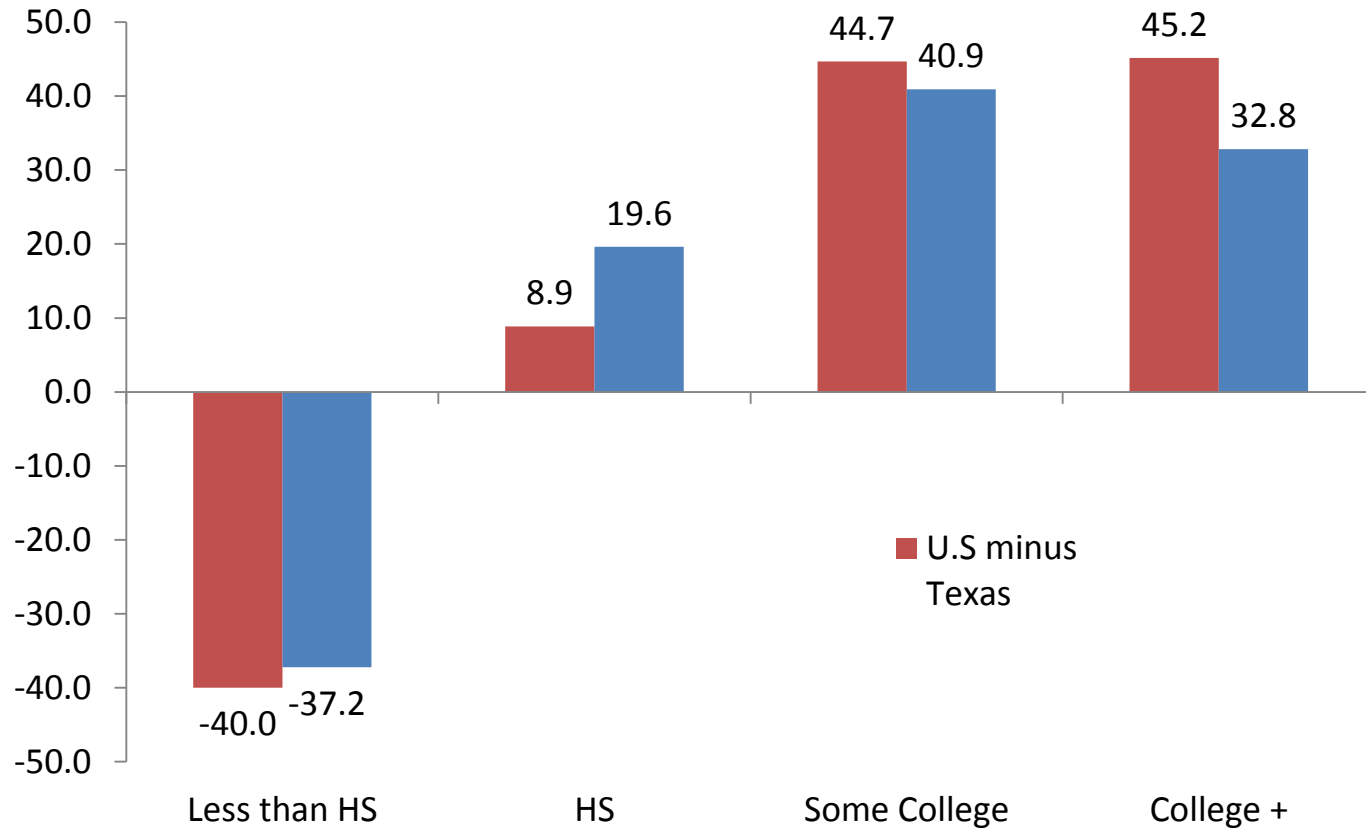
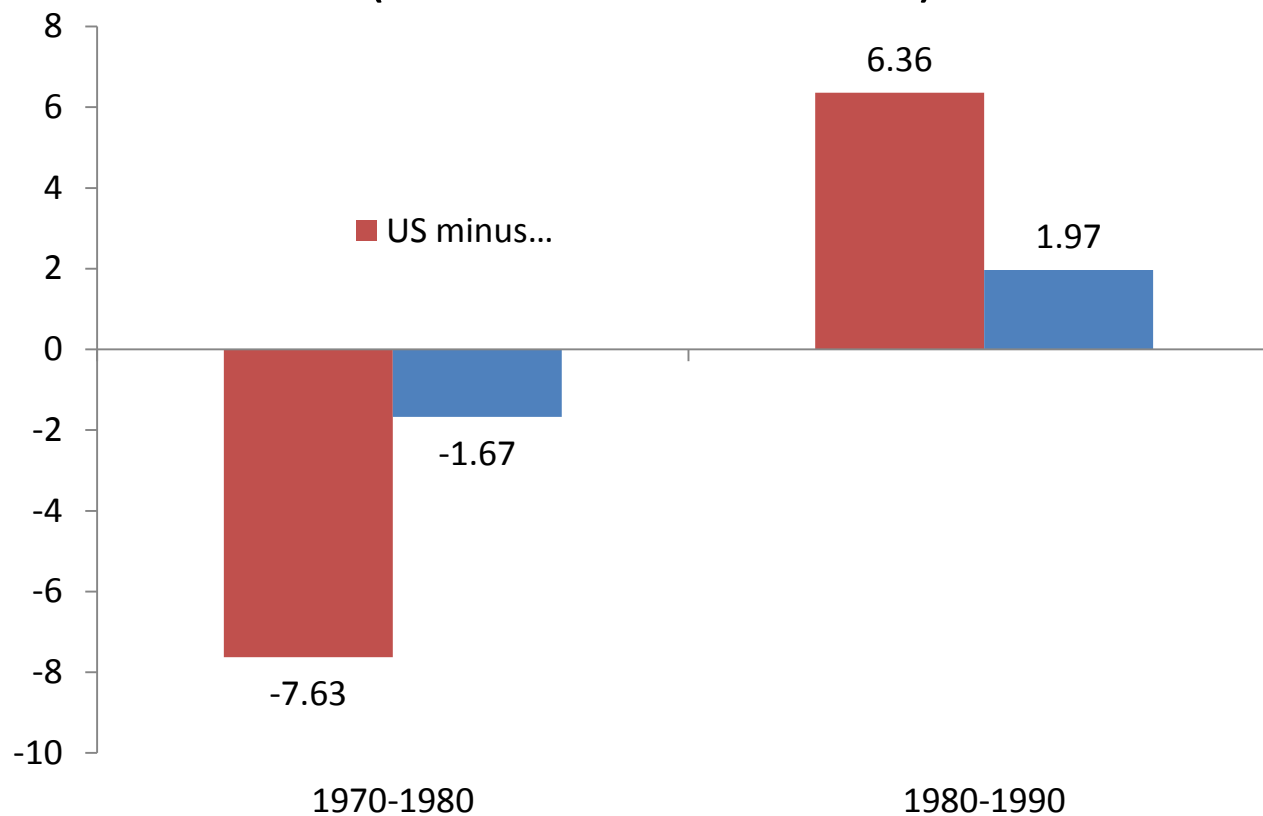


Table 2: Diff-in-diff Estimates of Impact of Oil boom and bust on Employment Share of Education  
(Dependent Variable: Categories of Education Attainment)  
(Treated Group: Oil & Gas Sector; Post-Treatment Period: After Oil Boom/Bust)

|   | (1)<br>No High<br>School   | (2)<br>High<br>School    | (3)<br>Some<br>College      | (4)<br>College+             |
|---|----------------------------|--------------------------|-----------------------------|-----------------------------|
| <b><i>Panel A: 1970-1980</i></b>        |                            |                          |                             |                             |
| Oil/Gas Sector                          | -0.042**<br>(0.009)        | -0.007<br>(0.009)        | 0.012*<br>(0.007)           | 0.037**<br>(0.007)          |
| After Oil Boom                          | -0.146**<br>(0.001)        | 0.024**<br>(0.001)       | 0.057**<br>(0.001)          | 0.065**<br>(0.001)          |
| <b>Oil &amp; Gas*After Oil<br/>Boom</b> | <b>0.059**<br/>(0.011)</b> | <b>0.004<br/>(0.012)</b> | <b>-0.023**<br/>(0.009)</b> | <b>-0.040**<br/>(0.009)</b> |
| N                                       | 1535403                    | 1535403                  | 1535403                     | 1535403                     |
| R-Sq                                    | 0.09                       | 0.02                     | 0.01                        | 0.05                        |
| <b><i>Panel B: 1980-1990</i></b>        |                            |                          |                             |                             |
| Oil/Gas Sector                          | 0.011*<br>(0.006)          | -0.004<br>(0.007)        | -0.006<br>(0.006)           | -0.001<br>(0.006)           |
| After Oil Bust                          | -0.096**<br>(0.001)        | -0.046**<br>(0.001)      | 0.111**<br>(0.001)          | 0.031**<br>(0.001)          |
| <b>Oil &amp; Gas*After Oil<br/>Bust</b> | <b>-0.006<br/>(0.008)</b>  | <b>0.007<br/>(0.011)</b> | <b>-0.026**<br/>(0.010)</b> | <b>0.026**<br/>(0.009)</b>  |
| N                                       | 1913836                    | 1913836                  | 1913836                     | 1913836                     |
| R-Sq                                    | 0.05                       | 0.02                     | 0.02                        | 0.06                        |

## Percent Change in Mean Real Hourly Wages (Texas vs. Rest of U.S.)



Source: 1% Census IPUMS obtained from Minnesota Population Center; Author's

Table 4: Diff-in-diff Estimates of Oil boom and Bust on Real Wage  
(Dependent Variable: Log of Real Wage)  
(Treated Group: Oil Area; Post-Treatment Period: After Oil Boom/Bust)

|                                 | (1)<br>1970-1980<br>(Oil Boom) | (2)<br>1980-1990<br>(Oil Bust) |
|---------------------------------|--------------------------------|--------------------------------|
| Oil Area                        | -0.216**<br>(0.043)            | 0.133**<br>(0.015)             |
| After Oil Shock                 | -0.063**<br>(0.014)            | 0.065**<br>(0.013)             |
| <b>Oil Area*After Oil Shock</b> | <b>0.349**<br/>(0.046)</b>     | <b>-0.029<br/>(0.043)</b>      |
| Observations                    | 1484611                        | 1864162                        |
| R-Sq                            | 0.01                           | 0.00                           |

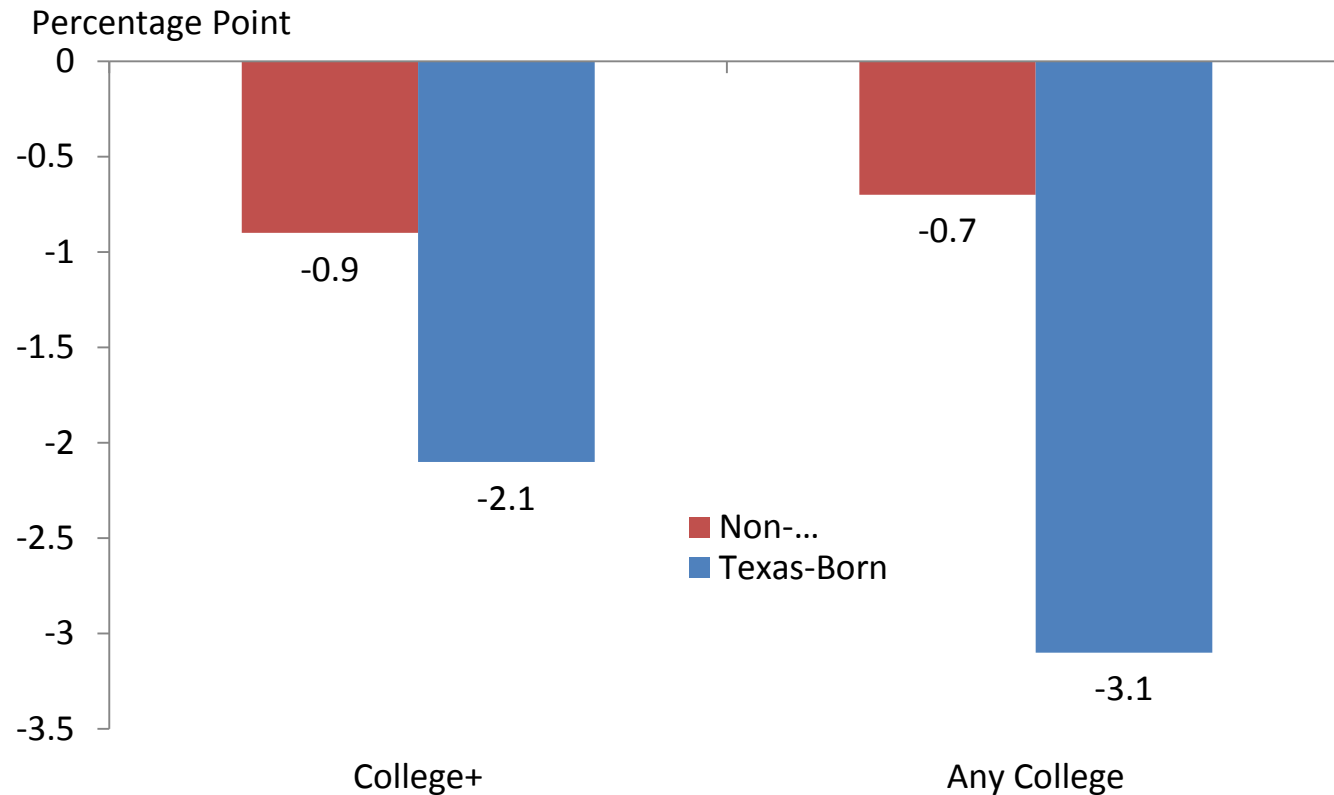
Table 5: Diff-in-diff Estimates of Impact of Oil boom and Bust on Skill Premium  
(Dependent Variable: Log of Real Wage)  
(Treated Group: Oil Area; Post-Treatment Period: After Oil Boom/Bust)  
(Omitted Category: High School Graduates)

|                                  | (1)                              | (2)                              |
|----------------------------------|----------------------------------|----------------------------------|
|                                  | 1970-1980                        | 1980-1990                        |
| OilArea                          | -0.126**<br>(0.033)              | 0.075**<br>(0.008)               |
| After                            | -0.097**<br>(0.008)              | -0.052**<br>(0.006)              |
| OilArea*After                    | 0.204**<br>(0.034)               | -0.062**<br>(0.026)              |
| Collegeplus                      | 0.319**<br>(0.005)               | 0.299**<br>(0.003)               |
| OilArea*Collegeplus              | 0.010<br>(0.021)                 | -0.018**<br>(0.004)              |
| After*Collegeplus                | -0.042**<br>(0.006)              | 0.049**<br>(0.004)               |
| <b>OilArea*After*Collegeplus</b> | <b>-0.037*</b><br><b>(0.022)</b> | <b>0.061**</b><br><b>(0.028)</b> |
| Intercept                        | 1.605**<br>(0.012)               | 1.592**<br>(0.007)               |
| Observations                     | 1462613                          | 1837173                          |
| R-Sq                             | 0.33                             | 0.34                             |

# Synthetic Cohort Approach

- Empirical approach similar to Emery, Ferrer, & Green (2012)
- Treatment group affected by oil boom
  - Texas-born who turned 17 when oil prices peaking (1978 to 1981)
- Control group unaffected by the oil boom
  - Texas-born who turned 17 during pre-boom (1970 to 1973)
- Compare education attainment of two groups in 2000 and 2010
- Net out any differences between the two cohorts born outside oil states
- Remaining difference interpreted as oil boom's impact

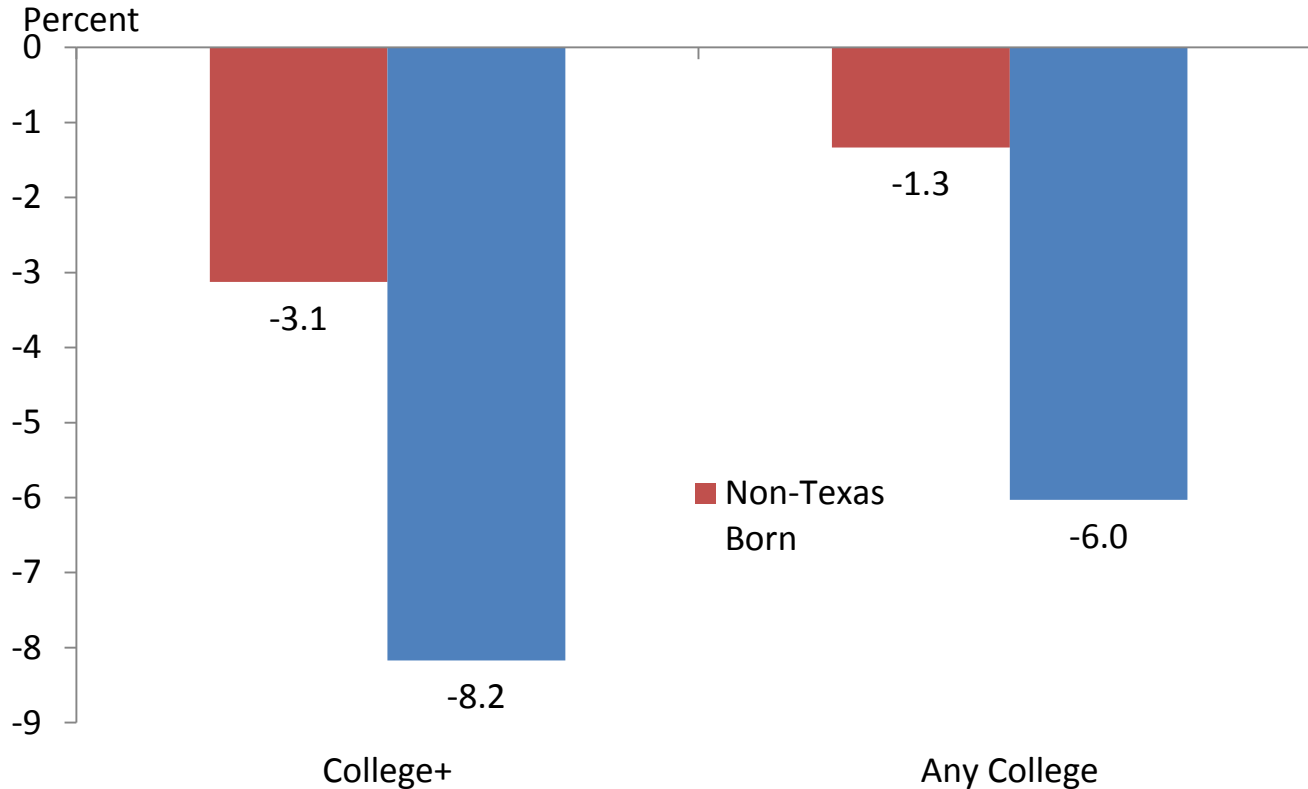
## Change in Share with College Education in 2010 (Boom Cohort *minus* Pre-Boom Cohort)



Source: 2010 ACS obtained from Minnesota Population Center; Author's calculations.



## Percent Change in Share with College Education in 2010 (Boom Cohort *minus* Pre-Boom Cohort)



Source: 2010 ACS obtained from Minnesota Population Center; Author's calculations.

Table 6: Diff-in-diff Estimates of Oil boom on Educational Attainment  
(Dependent Variable: Categories of Education Attainment)  
(Treatment Group: Cohort with Birth Year 1961-1964 turning 17 during Oil Boom)

|   | (5)                               | (6)                               | (7)                               | (8)                               |
|---|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|   | College+ 2000                     | College+ 2010                     | Any College 2000                  | Any College 2010                  |
| Oilstate Born                               | -0.018*<br>(0.010)                | -0.028**<br>(0.012)               | -0.008<br>(0.016)                 | -0.007<br>(0.017)                 |
| Post-Pre Boom                               | 0.010<br>(0.006)                  | 0.007<br>(0.005)                  | 0.010<br>(0.007)                  | 0.010<br>(0.008)                  |
| <b>Oilstate Born*</b><br><b>Boom Cohort</b> | <b>-0.016**</b><br><b>(0.005)</b> | <b>-0.014**</b><br><b>(0.005)</b> | <b>-0.013**</b><br><b>(0.007)</b> | <b>-0.025**</b><br><b>(0.008)</b> |
| Constant                                    | 0.060*<br>(0.035)                 | 0.113**<br>(0.038)                | 0.282**<br>(0.039)                | 0.355**<br>(0.060)                |
| Observations                                | 341239                            | 362057                            | 341239                            | 362057                            |
| R-Sq  | 0.10                              | 0.02                              | 0.08                              | 0.01                              |

# Conclusion

- Census IPUMS/ACS data from 1970 to 2010
- Primary findings
  - Oil boom associated with slower growth in the relative demand for skills
  - Significant impact on real wage growth
  - Insignificant impact on skill premium
  - Texas-born boom cohort less likely to have college education
    - 1 percentage point less likely to have a college degree
    - 2 percentage less likely to have any college
- Case for increased subsidies to higher education in oil-rich regions