Coal Safety and Productivity

Payne Institute Mini-Grant Presentation
Coal Mining Productivity

• Challenging times for the coal mining industry due to lower priced substitute products

• Productivity of mining an important component to remaining profitable

• Further, worker safety important part of the social license to operate

• Goal of this project is to determine how compatible worker safety and productivity are
General Determinants of Productivity

- Quality of Seam
  - Thicker, continuous seams should make the mine more productive

- Scale of production
  - Belief is that more production on site leads to higher productivity

- Price of Coal
  - Higher price in the market allows less productive mines to stay in business (which lowers average productivity)
Decomposition of Productivity Growth

Other Factors Proposed

• Market Structure
  • How customers write contracts with coal mines can alter their productivity
  • Power plants who face deregulated wholesale market write contracts that increase gains to productivity

• Mining Regulations
  • Mine Health Safety Act and others since then have some effect

• Safety Issues
What Data we have and what we run

• MHSA Address and Employment merged with the Accidents and Injuries for 1984-2014

• Production, employment, injury count, inspection, MHSA office, Seam Height, Mine ID, etc.

\[ \ln \left( \frac{Q_{it}}{L_{it}} \right) = \alpha_i + F(Q_{it}) + \beta_1 \text{Cont Prod}_{it} + \beta_2 \text{SeamHeight}_{it} + \beta_3 \text{InjperWorker}_{it} + \beta_4 \left( \text{Inj per Worker}_{it} \right)^2 + \beta_5 Y_t + \epsilon_{it} \]

• Mine fixed effects (\(\alpha\)), time fixed effects (\(Y\)), and a non-parametric scale effect (\(F(Q)\))
Initial Results

• Breaks in Production reduce productivity by about 10%

• Larger seam heights positively correlated with productivity
  • Even after mine fixed effects

• Injuries have a concave relationship with productivity
  • As injuries increase at first, productivity increase but the rate of productivity increase declines quickly so that further increases in injuries lower productivity
Scale effects are fairly small.

Once a minimum scale is reached, little productivity gains.
Potential, Interesting Questions

• Update determinants of productivity to include newer data and methods

• Look more closely at how accidents/injuries alter the productivity
  • More serious injuries vs less serious ones

• Enforcement of safety regulations
  • Reputation of MHSA office
  • Political situation of state-elected officials (term limited, League of Conservation scores, etc.)
  • Impact of enforcement action on others (general deterrence) vs. enforcement action on you (specific deterrence)